Imagery or Video Feedback: Which is the "Route" to Strategic Improvement?

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ABSTRACT

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(Under the supervision of Diane Stevens)

The implementation of imagery and video feedback programs has become an important tool for aiding athletes in achieving peak performance (Halliwell, 1990). The purpose of the study was to determine the effect of strategic imagery training and video feedback on immediate performance. Participants were two university goaltenders. An alternating treatment design (ATD; Barlow & Hayes, 1979; Tawney & Gast, 1984) was employed. The strategies were investigated using three plays originating from the right side by a right-handed shooting defenceman from the blueline. The baseline condition consisted of six practices and was used to establish a stable and "ideal" measure of performance. The intervention conditions included alternating the use of strategic imagery (Cognitive general; Paivio, 1985) and video feedback. Both participants demonstrated an increase in the frequency of Cognitive general use. Specific and global performance measures were assessed to determine the relative effectiveness of the interventions. Poor inter-rater reliability resulted in the elimination of specific performance measures. Consequently, only the global measure (i.e., save percentage) was used in subsequent analyses. Visual inspection of participant save percentage was conducted to determine the benefits of the intervention. Strategic imagery training resulted in performance improvements for both participants. Video feedback facilitated performance for Participant 2, but not Participant 1. Results are discussed with respect to imagery and video interventions and the challenges associated with applied research.

KEYWORDS: imagery, video, goaltenders, alternating treatment design

Dedication

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LITERATURE REVIEW

Introduction

Imagination has been a historical topic of debate dating back to Aristotle (384-322 BCE), in *De Anima* and *Parva Naturalia* (Ross, 1931). Aristotle believed that the soul never thought without an image. Hence imagery played a rudimentary role in cognition. This was the accepted "theory" until the arrival of behaviorism in the early twentieth century. Watson (1931) felt that imagery lacked scientific status and even doubted it's very existence. The development of cognitive psychology placed imagery in the forefront of scientific inquiry. Experiments on mental rotation found that imagery could be empirically examined and that it did not depend on introspection (Shepard, 1978a; 1978b). Paivio's (1971; 1986) dual coding theory (imagery and linguistic encoding) provided additional empirical evidence for the mnemonic effect of imagery. As imagery research has flourished in the past three decades it has become more prominent in applied settings such as sports. Martin, Moritz, and Hall (1999) estimated that over 200 studies have examined connection between imagery and sport performance.

Research in mental imagery has led sport psychologists to acknowledge imagery as an important cognitive tool in their quest to aid athletes in achieving peak performance (Feltz & Landers, 1983; Richardson, 1967a). Murphy, Jowdy, and Durtschi (1989) found 90% of athletes, 94% of coaches, and 100% of sport psychologists implemented imagery in their training/work. Imagery allows an athlete to practice for competition as s/he never could expect to train for in reality due to time, fatigue, costs, facility restriction, injury or illness. Further, imagery allows an individual to practice physical, mental, and emotional responses to events that may or may not occur during performance. This ability to

mentally rehearse "real life" variables may aid in alleviating mental pressures which athletes experience. For instance, the ability to image may aid goaltenders in staying focused (e.g., warmed up) during extended periods of isolation, which occur in both games and practices.

Imagery defined

Mental imagery is defined as "those quasi-sensory and quasi-perceptual experiences of which we are self-consciously aware and which exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts" (Richardson, 1969, p. 2-3). Imagery can duplicate and create sensory and perceptual experiences, without those sensory or perceptual cues being present. An individual is aware of his/her imagery, which allows for the control and manipulation of the image. Imagery can be differentiated from dreaming which involves no control and occurs in the subconscious (White & Hardy, 1998).

Imagery is often used synonymously with the term visualization. However, this categorization may be misleading, as the latter refers only to re-creating an experience in the mind's eye (i.e., visually), whereas imagery can employ all senses, (i.e., auditory or olfactory). Through the use of imagery, the athlete uses visual and kinesthetic feedback to make corrections in motor skill performance (Richardson, 1967).

Imagery is a process that requires an individual's complete concentration to formulate and control the contrived image (Orlick, 1990). Imagery facilitates the execution of skills, plans and strategies (Hall, Schmidt, Durand, & Buckolz, 1994; Munroe, Giacobbi, Hall, & Weinberg, 2000) and also modifies cognitions such as self-efficacy (Feltz & Riessinger, 1990) and self-confidence (Callow, Hardy, & Hall, 1998).

Characteristics of imagery: Foundational concepts

Imagery type. Imagery is typically subdivided into two main categories; visual and kinesthetic. Visual imagery is recreating in the mind a skill in the visual perspective (e.g., seeing the golf ball go in the hole). Visual imagery can be further "broken-down" into internal and external dimensions. Internal imagery is viewed from a first person perspective. The individual images performing the task as if he/she were physically performing it (e.g., looking at the puck through his/her cage and only seeing gloves and a stick, but not the rest of his/her body). External imagery is from a third person perspective. An individual adopting this perspective images him/herself as if on a video (e.g., seeing his/her entire body and external stimuli).

Researchers have investigated whether internal or external imagery is most conducive to performance success. Results have been inconclusive with some researchers demonstrating that an internal perspective is more effective (Mahoney & Avener 1977; Weinberg, 1982) while others suggesting that both perspectives are mutually effective (Highlen & Bennett, 1979; Meyers, Cooks, Cullen & Liles, 1979; Mumford & Hall, 1985). Hardy (1997) clarified the above by suggesting an interaction between perspective and specific characteristics of the skill being imaged. He hypothesized that skills emphasizing aesthetic qualities or precise body positions would benefit from external imagery. Conversely, an internal perspective would be beneficial for skills that are simple, well-learned or in which one needs to respond to external information. Recent research has supported the above contention (Hardy & Callow, 1999; White & Hardy, 1995).

Kinesthetic imagery is the ability to replicate the physical feeling/sensation of a task in one's mind (e.g., a diver's body awareness during spins and summersaults). These imaged feelings/sensations strengthen neural traces of actual somatic feelings/sensations, which provides a cognitive reference essential for skill replication (Sackett, 1934).

A common assumption has been that kinesthetic imagery could only be used by those who adopted an internal visual perspective (Barr & Hall, 1992; Epstein, 1980; Hall, Rodgers, & Barr, 1990; Mahoney & Avener, 1977). In other words, an external perspective is only visual in nature. Recent research however, has demonstrated that athletes are capable of experiencing kinesthetic sensations from either an internal or external perspective (Glisky, Williams, & Kihlstrom, 1996; Hardy & Callow, 1999; White & Hardy, 1995). An example of an external-kinesthetic perspective would be a figure skater who visually images the distance to the boards (i.e., spatial awareness) to perform a jump, and then reverts to the kinesthetic sensation of the tuck when he/she is in the air spinning during a triple axel (i.e., body awareness).

Imagery ability. When implementing imagery, the ability of the imager must be considered. All individuals have the capability to engage in imagery, but not to the same extent. The ability to visually and kinesthetically image has been associated with enhanced performance (Highlen & Bennett, 1983; Orlick & Partington, 1988). Further, greater performance improvements have been demonstrated by those high in imagery ability compared to those low in imagery ability (Goss, Hall, Buckolz, & Fishburne, 1986; Isaac, 1992).

Level of competition. Sport experience has also been identified as a mediating variable in the benefits of images. Elite athletes have been shown to benefit more from

imagery than novices (Feltz & Landers, 1983; Jones & Stuth, 1997; Lohr & Scogin, 1995; Noel, 1980; Weinberg, 1982). Pie, Tenenbaum, Bar-Eli, Eyal, Levy-Kolker, and Sade, (1996) suggested that elite athletes were more effective at integrating imagery into their training regime. Expert athletes demonstrate well ingrained motor sequences associated with successful performance which result in a high level of domain specific intelligence. This information would be stored as a network of systematically linked propositions in long-term memory.

Vividness and controllability. Two important components in understanding and teaching imagery are the vividness and controllability of the image (Vealey & Greenleaf, 1998). Vividness is the clarity, sharpness, colour, emotional, and physical realness of the situation imaged (Smith, 1987). Studies have suggested vividness is positively associated with performance (Isaac, 1992; Rodgers, Hall, & Buckolz, 1991; Start & Richardson, 1964).

Controllability refers to the effortlessness and accuracy with which an image can be changed or manipulated (Kosslyn, 1990). Controllability is important to enable the athlete to image different outcomes, techniques, and strategies in order to cover various situations, which may transpire during a task or competition. Smith (1987) suggested that controllability was associated with imagery effectiveness, which may result in superior performance.

Theories of imagery

Psychoneuromuscular theory. Jacobson's (1932) psychoneuromuscular theory states that imaging a physical skill results in sub-threshold electrical stimulation of muscles and the nervous system. Further the stimulation experienced is similar to that

which occurs during actual physical performance. Vealey and Walter (1993) suggested that imagery strengthens the neural pathways, referred to as "muscle memory", and that imagery could format muscles to fire the same way as during an actual task. Research indicates that measurable, electrical stimulation during imagery occurs at a fraction of the intensity and magnitude, and results in no or minute apparent motions (Anderson, 1981; Corbin, 1972). Changes in muscle tension can provide a real-time indictor of information processing (Richardson, 1967).

A common concern among critics of the psychoneuromuscular theory has been offered. While well-suited for describing imagery effects on motor skill performance, the theory does not appear to be appropriate for explaining the effects of imagery on tasks which do not require muscular innervation (i.e., cognitive tasks). Further, empirical investigations have offered inconclusive support for the psychoneuromuscular theory (cf. Murphy & Jowdy, 1992). These limitations suggest that a broader, more cognitively based theory may be needed to explain imagery effects

Symbolic learning theory. A second theory forwarded to explain the benefits of imagery is the symbolic learning theory (Sackett, 1934; 1935). It differs from the psychoneuromuscular theory by suggesting that imagery effectiveness is a function of symbolically coded cognitive components, which create a "mental blueprint" (Vealey & Walter, 1993) and not muscular activation. The theory suggests that the more frequently a skill is imaged, the stronger and more accessible the memory traces will become.

Empirical evidence exists that vivid imagery can create the same mental blueprint as physical practice (Hird, Landers, Thomas, & Horan, 1991; Minas, 1980; Ryan & Simons, 1981; 1983). The symbolically coded blueprint enable athletes to (1) cognitively

rehearse numerous aspects of a task in the correct order, (2) take into account spatial task characteristics, potential problems, and goals, and (3) plan movement performance (Fitts & Posner, 1967; Minas, 1978; Sackett, 1934; 1935; Wrisberg & Ragsdale, 1979). This theory suggests that imagery will be more effective for cognitive tasks (e.g., dial-a-maze task) than for purely motor tasks (e.g., power lifting).

Bioinformational theory. The previously identified theories suggest that imagery enhances motor skill learning by mirroring the physical practice of the skill. However imagery, as used by sport psychologists, encompasses a more diverse range of applications than motor skill improvement and using imagery as a substitute for physical practice. The bioinformational theory (Lang, 1979; 1985) extends both the psychoneuromuscular and symbolic learning theories to include the physiological and emotional reactions experienced in response to imagery.

According to the bioinformational theory, all knowledge is represented in memory as a semantically-linked network of processed, abstract units of information regarding objects, relationships, and events. These units of information are termed propositions, of which there are three fundamental categories: stimulus, response, and meaning propositions. Stimulus propositions reflect external environmental factors (Lang, 1979; 1985). For example, imaging taking a penalty kick in the final minute of a close soccer game would involve the stimulus propositions of the distance from the net and the noise made by the crowd. Response propositions describe the physical responses of the individual to the situation. These responses can include motor actions, such as the kick and body position, and autonomic changes such as sweating and increased heart rate. Meaning propositions are rational interpretations of information not stemming from the

stimuli in the situation. They define the importance of events and the results of action. For example, a meaning proposition may be that there is only one minute left in the game and that winning the game means the team gets into playoffs. Imagery will be the most effective when all three propositions are included in the image as the image created is more "realistic" and various actions and reactions to any scenario can be practiced mentally.

Applied sport psychologists have promoted the importance of including physiological and emotional reactions into imagery (Orlick, 1986; Suinn, 1972; 1986). Suinn (1985) stated that instructing athletes to experience an imagined scene as if it were actually occurring (i.e., feeling muscular and emotional reactions) facilitated improvement in performance and recall. Little empirical research has examined the effects of including stimulus response propositions in imagery scripts on performance. One such study was conducted by Smith, Holmes, Whitemore, Collins, and Devonport (2001) who randomly assigned novice field hockey players ($N = 27$) into one of two imagery groups or a control. Results demonstrated significant performance improvements for those in the stimulus + response proposition imagery group compared to those in the stimulus proposition imagery group only. Both imagery groups recorded superior performance over the control.

It has been proposed that internal imagery may be best suited to facilitate response propositions (Hale, 1982; Harris & Robinson, 1986; Suinn, 1985). Conversely, it has been proposed that an external imager can also experience psychophysiological changes during imagery (Lang, Kozak, Miller, Levin, & McLean, 1980). For this to occur, several factors must be considered. First, an imagery script detailing the scene

needs to describe a situation, which, if encountered in vivo, would involve psychological activity (Lang et al., 1980). Second, instructions that direct the athlete's attention to experience the image physiologically activate the response propositions. This effect is strongest when imagery scripts contain reference to muscular and visceral responses (Lang, Levin, Miller, & Kozak, 1983). Third, physiological changes are highly correlated with self-rated "good" imagers (Levin, Cook, & Lang, 1982). Finally, personally relevant scenes are more likely to activate response propositions (familiarity increases activation) (Miller, Levin, Kozak, Cook, McLean, & Lang, 1986).

Analytic framework of imagery functions

Up to this point in the literature review, theoretical approaches to imagery only examined how imagery facilitates the development of motor skills. Paivio's (1985) analytical framework provides an outline for other functions of imagery use. Paivio suggested that both motivational and cognitive factors influence imagery of motor behaviour and that both components exist at a specific and a general level. Hall, Mack, Paivio, and Hausenblas (1998) extended Paivio's original taxanomy by subdividing the Motivational General component into two dimensions. As such, five functions of imagery use have been identified and are as follows:

1. *Motivational Specific (MS)* - imagery that represents the achievement of specific goals such as imagining oneself winning an event.
2. *Motivational General-Mastery (MG-M)* – imagery associated with effective coping and the mastery of challenging situations. Items such as imagining being mentally tough and confident reflect this function of imagery.

3. *Motivational* General-Arousal *(MG-A)*- imagery associated with feelings of relaxation and arousal in sport competition. Imaging yourself being calm and collected during a free throw in basketball would represent this function.
4. *Cognitive-Specific (CS)* – imagery of specific sport skills, for instance imaging the mechanics of a golf swing.
5. *Cognitive-General (CG)* – imagery of the strategies and routes associated with competition for instance a figure skating routine.

Research examining the functions of imagery use

In this section, research specific to the five functions of imagery use is summarized with specific attention to the type of imagery most important to the present investigation--Cognitive General Imagery.

Motivational specific. When athletes image the achievement of specific goals they are using MS imagery. Research has indicated a positive association between enhanced performance when a successful outcome was imaged (Woolfolk, Murphy, Gottesfeld, & Aiken, 1985; Woolfolk, Parrish, & Murphy, 1985). MS imagery can be incorporated with performance goals and used to maintain motivation leading up to competition (Hall, 1995; Martin & Hall, 1995; Munroe, Hall, Simms, & Weinberg, 1998; Orlick, 1990). Martin and Hall suggest, "When it comes to enhancing motivation, imagery and goals may go hand in hand" (p. 66). Hence athletes should always image a positive obtainable outcome.

Skill level may moderate the effectiveness of MS imagery on performance. Burhans, Richman, and Burgey (1988) trained novice runners to use either CS imagery (perfect execution of the movements associated with running) or MS (crossing the finish

line first). Results indicated that those employing CS imagery demonstrated greater performance improvements than did those using MS imagery. However, Hall et al. (1998) found that MS imagery facilitated performance for National level track and field competitors success. Therefore, for those who have virtually mastered the physical skills associated with their sport, preliminary evidence suggests that MS imagery is effective for performance enhancement. For novices however, imagery associated with skill may be more beneficial.

Motivational general-arousal. Lang's bioinformational theory (1977; 1979) indicates that certain images can elicit changes in one's physiological arousal. Empirical evidence exists to support the notion that MG-A imagery can increase arousal (Hall et al., 1998). For example, Hecker and Kaczor (1988) demonstrated that when MG-A imagery was used, athletes' heart rates significantly increased above baseline levels. Cognitive specific imagery was not associated with corresponding changes in heart rate. Practitioners have also advocated the use of MG-A imagery to "psych-up" or calm down athletes prior to competition (Cancio, 1991; Hall et al., 1998; Orlick, 1990; White & Hardy, 1998). As such, imagery of sport specific situations may elicit physiological responses that mirror those found in the real situation.

Motivational general-mastery. MG-M imagery has been effective for enhancing an athlete's self-confidence (Callow et al., 1998; Moritz, Hall, Martin, & Vadocz, 1996; Vadocz, Hall & Moritz, 1997). Moritz et al. suggested that MG-M imagery enhances self-efficacy because it incorporates imaging all aspects associated with a successful performance. Utilizing MG-M imagery may modify cognitions through positive

emotional responses in stressful situations. Hence those who image the ability to positively cope may be more successful than those who do not (Lazarus, 1991).

Cognitive specific. Imagery for the enhancement of skills is by far the most fully explored function of imagery (e.g., Denis, 1985; Hall, Buckolz, & Fishburne, 1992). Cognitive specific imagery involves the mental rehearsal of a motor skill. It is generally accepted that imagery of fine and gross motor skills aids in the learning, acquisition, and performance of that skill (Straub, 1989; Wrisberg & Anshel, 1989). Most advanced athletes who exhibit well-developed skills, habitually incorporate a substantial amount of CS imagery in their practice routines (Hall et al., 1998; Moritz et al., 1996). When learning new skills, advanced athletes are presumed to employ CS imagery to facilitate learning. Cognitive specific imagery also aids athletes in the refinement of a well-learned skill (Munroe et al., 1998). It is generally acknowledged that that CS imagery enhances the learning and performance of motor skills, but not to the same magnitude as physically practicing the skill (Driskell, Copper, & Moran, 1994; Hall et al. 1994).

Cognitive-general. Anecdotal and empirical evidence suggests that athletes use strategic imagery to benefit performance of tactical play. Athletes report using imagery to rehearse entire game plans, strategies, routes, and races/routines (Madigan, Frey, & Matlock, 1992). Bill Glass, former defensive end of the Cleveland Browns has stated that imagery was a contributing factor in his All Pro selection. He visualized himself as in a "motion picture" practicing the quick moves, throwing off the offensive tackle and aggressively charging the quarterback (Furlong, 1979). Amad Rashad a former member of the Minnesota Vikings, remarked that imagery was an influential factor to his success. He continued by adding, "I got ready for a game by imaging every possible move a

defender might use." (Dorfman & Kuel, 1989, p. 143). Chris Evert famous for her technically sound strokes and consistency, disclosed that she employed imagery before every match. She concentrated on anticipating her opponent's strategy and style and imaged her counter attack (Lazarus, 1977).

CG imagery has been positively associated with confidence in athletes of various skill levels (Abma, Fry, Li, & Relyea, 2002; Callow & Hardy, 2001). Case study reports have documented the performance benefits of cognitive general imagery for rehearsing football plays (Fenker & Lambiotte, 1987), wrestling strategies (Rushall, 1988), entire canoe slalom races (MacIntyre & Moran, 1996), and soccer strategies (Munroe, Hall, Fishburne, & Shannon, unpublished manuscript). Based on these reports, cognitive general imagery can have a significant effect on athletic performance.

Fenker and Lambiotte (1987) conducted an enhancement program using relaxation and imagery on a college football team. Following training surrounding imagery ability, the athletes were asked to image executing "great plays" making "fantastic catches," or running, blocking, or tackling like superstars. They were encouraged to image the highest level of performance imaginable even if the image exceeded the actual skill level they possessed. Some players utilized imagery of the perfect play on the bench during the game to facilitate their actual physical performance. The intervention was believed to contribute to the team's record during the year (8-4-0).

Rushall's (1988) case study of a Canadian Olympic wrestler utilized strategic imagery to aid in the reconstruction of self-confidence. The wrestler experienced a loss of confidence while he was on tour with higher skilled athletes. This resulted in a reduction in performance and severely affected his ability to conceptualize any positive

performance images. The lack of positive image formation resulted in Rushall implementing a covert modeling intervention. Covert modeling entails imagery of someone else performing the task. Gradually the wrestler's images were faded to form an image of himself. The imagery strategies employed were: Walking onto to the mat, glaring fiercely, breathing faster, wanting to attack and finally on the mat ready to attack. The imagery intervention proved to be successful with the wrestler regaining his aggression and aptitude to wrestle.

Cognitive general imagery is extremely important to canoe-slalom racers as no practice runs are provided. Athletes needed to cognize the optimal route for speed and the negotiation of hazards. MacIntyre and Moran (1996) explored this function of imagery in their qualitative and quantitative investigation of pre route selection of a canoe-slalom race. Participants were international canoe-slalom racers ($N = 12$) from four different countries. Participants were asked to image a recent major race, in which they were to report on the various senses they experienced on a 7-point Likert scale. In addition, participants were asked to comment on the details of the sensory modality of the image. Responses revealed that eight of the participants utilized both an internal and external perspective, while others used only one perspective. The modalities employed were vision (e.g., seeing objects in relation to one another and colours) or kinesthetic (e.g., sensing the force of the water and movement). Most of the participants who had a visual response disregarded the kinesthetic aspect in their report. The main application for the participants' imagery was planning their route, followed by route revisions. Consequently, strategic imagery was of prime importance to these athletes.

Munroe et al. (2003) investigated the effect of CG imagery on a juvenile female soccer team. The three proposed tactics were: 1) defending a direct free kick; 2) taking a direct free kick; and 3) defending a corner kick. Only the third was examined due to a lack of trials. The play was analyzed by two independent raters via videotape. The study found that imagery was frequently used prior to the intervention, and that the imagery intervention increased the participants' imagery use. As a result of the lack of trials the authors felt that few conclusions regarding CG could be drawn.

The Use of Video in Performance (Learning)

The use of digital video as a means of enhancing athletic performance for sport psychologists has only recently been highlighted (Ives, Straub & Shelley, 2002). Before the 90's it was not practical for most to use video technology due to equipment, time constraints and cost (Gipson, McKenzie, & Lowe, 1989). Now it is common for parents to own video cameras and film their children engaged in sport. Advances in high-speed digital technology will soon make video accessible to every sport psychologists' arsenal. This modern technology is opening up new horizons, which will allow sport psychologists to delve deeper into motor skill and perceptual training.

Theories of video feedback

Social cognitive theory. Bandura (1986) suggested that observation of a model facilitates the development of a cognitive blueprint in the learner. The role of observational learning in the development of behaviours serves as the basis for Bandura's (1986) social cognitive theory. The theory postulates that the majority of social learning in early childhood development occurs through casual or direct observation of performances by real-life models, which in turn are committed to memory and imitated.

Research supports the benefits of model demonstration during observational learning versus no model demonstrations (Bird, Ross, & Laguna, 1983; Blandin & Proteau, 1994; Feltz, 1976; Flanders, 1968; Landers, 1975; Landers & Landers, 1973; Pollock & Lee, 1992). Bandura further suggests that response information can be transferred through different mediums such as imagination, physical demonstration, pictorial representation, and verbal description. Consequently, learning is facilitated through observing others. Further, modeling reduces time consuming performances of incorrect responses.

Self-modeling theory. Advances in technology have resulted in the extension of the social cognitive theory. Dowrick (1999) developed the self-modeling theory and defined self-modeling as an "intervention procedure using the observation of images of oneself engaged in adaptive behavior" (p. 23). Self-modeling is a unique training method as it provides a realistic picture of the learning taking place during the acquisition of a skill. The use of video as described by Dowrick can heighten learning, well-being, and performance across seven domains: (1) clarifying goals and outcomes; (2) demonstrating a positive self-image; (3) the recollection of previous performance success; (4) repeating observations of competent role-play; (5) observing one's skills applied to a new setting; (6) producing anxiety-free behaviour or successful outcome despite anxiety; and (7) demonstrating new skills composed of preexisting subskills.

Video Use

Research examining the use of video. Despite numerous testimonials of coaches and athletes, video feedback is a relatively unexplored modality for performance enhancement. The majority of studies have employed video for movement analysis (Grau, Baur, & Horstman, 2003; Lerda & Cardelli, 2003). The research which has

examined video as a training tool has predominately involved skill acquisition such as a golf swing (Guadagnoli, Holcomb, & Davis, 2002), field hockey skills (Russell, 1993), and the tennis serve (Van Wieringen, Emmen, Bootsma, Hoogester, & Whiting, 1989).

Guadagnoli et al. (2002) investigated efficacy in relation to video instruction, verbal instruction and self-guided skill acquisition on performance of a golf swing. Thirty participants were randomly assigned to a video, verbal or self-guided group. The video group had an instructor who used video as an aid during feedback. The verbal group had an instructor who provided verbal feedback only. The self-guided group autonomously learned the skill. Two evaluations of the participants' golf swings were performed; the first resulted in the self-guided group outperforming the two feedback group. The second test resulted with two feedback groups demonstrating better performance than the self-guided group. The video group demonstrated the greatest increase in performance. It was concluded were that the feedback interventions were beneficial to performance however their impact may be delayed.

Russell (1993) explored the benefits of video feedback on field hockey skills (i.e., Indian dribble and moving drive). Participants were 47 juvenile female physical education students who were randomly assigned to either a video feedback or traditional feedback (i.e., verbal instruction and demonstration) groups. The Indian dribble produced inconclusive results in determining which intervention was better. The moving drive however demonstrated that video feedback was a better tool in enhancing performance.

Van Wieringen and colleagues (1989) examined the influence of video feedback on the service of intermediate tennis players. Participants were randomly assigned into

three groups: a video feedback training (VFT) group, a traditional training (TT) group, and a control group. These groups consisted of 22 participants each. The VFT and TT group practiced twice a week for five consecutive weeks. The training sessions were 30 minutes long with an additional 10 minutes of viewing and discussing video of oneself (VFT) or that of a professional tennis player (TT). The control group did not receive any training. The VFT and TT groups showed significant improvement in achievement scores and technique compared to the control. However, no differences between the VFT and TT groups were observed.

The use of video in sport psychology. Video plays a significant role in directing mental effort, focusing attention, and proper intent. Because of the power of video, Williams and Grant (1999) suggested that video stands alone as the most appropriate perceptual motor training tool. The following section will summarize the ways in which video technology has been used in sport psychology research or by practitioners.

The use of video for coaches. Elite coaches have used video/film to analyze and improve technical and tactical aspects of sport since its conception (McGinnis, 2000). When a group of top American football coaches were asked to finish the statement, "The most important technological innovation for coaching football has been..." all replied that video "cuts" and the ability sort them into desired criteria were the most important (Smith, 2002). When Brian Billick took over as the Baltimore Ravens head coach, the organization put high emphasis on computer technology, which they credit in part for the Super Bowl championship run in 2000. Ted Leonsis, owner of the Washington Capitals, has implemented video on the bench during games. The video allows players to view tendencies of the opposing team, which can then be exploited. Video also enables the

coaching staff to aid in the reconstruction of a poor play, and provide the ability to identify what might have been the optimal tactic.

A video recording acts as an objective measurement tool, which does not forget nor is it swayed by emotion. The permanent storage of information allows coaches to process and compare observational changes in performance from game to game or throughout an entire season. This modality allows for in-depth coaching analysis and facilitates feedback, which in turns aids skill development. It is inconceivable to think that a coach is able to recall every aspect of a game. Franks and Miller (1986) demonstrated that the memories of soccer coaches were less than 45% effective in recalling the last 45 minutes of a game.

Further, video in team sports provides coaches the opportunity to examine all aspects of a game. Normally coaches are concerned with the high action areas, which results in other areas being neglected. Through conventional coaching, a plethora of feedback is lost through the inability to observe or recall information. The use of video also facilitates the conceptualization of game plans. Instead of the old X's and O's method that in most cases is highly inaccurate in the spatial sense of the game, video enables athletes to see precise distances and exactly how they reacted to stimuli. This reproduction allows the athletes to concentrate on the coach's instructions rather than attempting to remember what they did.

Some challenges that coaches and sport psychologists experience are in the interpretation of what an athlete is thinking and how they perceive their performance. The use of video and open communication may facilitate this interpretation and help decipher discrepancies between the perceptions of the athletes as to what actually occurred during

performance. Once this knowledge is acquired the ability to aid an athlete in cognitively processing information is enhanced. It is a lot easier to correct a problem when both parties are observing the same scene than when attempting to cognize each other's perspective. Video also allows the athlete to pinpoint exact moments in time, in which they experienced different thoughts and emotions. Through video recall, strengths and weaknesses can be identified with precision, to construct a graphical framework from which a well formulated mental training program can be forged.

Strategy: decision-making ability. Abernethy (1996) suggested that using video to train anticipatory and decision-making skills were the most practical places to start when introducing video technology. Vickers, Livingston, Umeris-Bohnert, and Holden (1999) share a similar view as they have assessed perceptual skill through complete video viewing (i.e., decision training) in laboratory experiments. For example, athletes can observe themselves or a teammate in a strategically occluded video, and be asked what response will/should come next. Players can also view opponents in this fashion to better predict their opponent's idiosyncrasies (McGarry & Franks, 1996).

It is a commonly shared belief that novice and elite performers differ in cognitive and perceptual skills. Elite performers have demonstrated faster and more accurate decision making, to be more efficient at selecting pertinent sensory information, to anticipate and more easily cognize actions, and to have a vast elaborate domain-specific knowledge base (i.e., tactics and strategies; Abernethy, 1996; Helsen & Starkes, 1999; Singer & Janelle, 1999). In the past these skills could only have been improved though actual performance. With the use of video, athletes can view countless situations that may not be experienced in reality due to time and fatigue.

Video decision-making strategies may become an interesting addition for coaches' team selection criteria. In the not so distant future, athletes could be asked to view occluded game footage and hypothesize what they believe might play out (i.e., the opposing player's move and the correct counter). Williams (2000) believes this type of talent identification is in its preliminary stages, but it is likely to become significant in distinguishing those players with the potential to become elite performer.

Combining imagery and video use

Weinberg (1982) suggested that procedures such as reading a description or watching a film of a properly performed task can be used to enhance imagery. Further, Halliwell (1990) commented that videos, in combination with imagery, facilitated "remarkable performance changes" (p.371) in NHL athletes. Hall and Erffmeyer (1983) found that video and CS imagery significantly improved free throw shooting accuracy of female intercollegiate basketball players compared to baseline scores. The combination of imagery and video feedback's effectiveness on performance is well documented, but a further question must be asked: Which intervention is most beneficial to strategic performance? To date, this question remains unanswered.

Applied research

Sport psychology applied research attempts to aid athletes enhance performance in various tasks with an emphasis on skill acquisition and motivation. Applied research is predominately descriptive in nature (Finsterbusch & Motz, 1980) with its primary strength existing in its immediate practical use for the individual (Freeman, 1983). The major weakness of applied research is the lack of control over real life occurrences that may influence results. These limitations are often eliminated in controlled, more artificial

laboratory experiments. Consequently these laboratory experiments may not reflect real life situations which are invaluable to athletes.

One type of applied research is evaluative in nature and is defined as "the process of establishing value judgements based on evidence" (Smith & Glass, 1987, p. 31). Evaluation research measures the effectiveness of an intervention. An example would be: Does the use of self-talk improve performance? Evaluation research is frequently descriptive but can be exploratory or explanatory (Smith & Glass, 1987). Applied research can be conducted according to a variety of designs and methodologies. For the purpose of the present investigation, a case study design was chosen which employed an alternating treatment design.

Case study. Much of the imagery and video research to date has used group design methods that compare the performance of a treatment group to that of a non-treatment control group (Bryan, 1987). Group designs do not reflect small increments of improvement, and have the potential to obscure individual positive benefits through averaging participants' results. It is also important to remember when examining athletes who have achieved a high level of performance, ceiling effects may influence results. Therefore, statistical analyses may not reveal significant results for expert performers. Despite the non-statistical significance, these small changes may be very valuable to these elite athletes.

Zaichkowsky (1980) suggested that having non-treatment controls poses an ethical dilemma to most coaches and athletes, when conducting research in applied settings. Consequently a case study may be most beneficial for intervention with elite athletes (Wollman, 1986).

Case studies are defined as "...an empirical enquiry that investigates a contemporary phenomenon within its real life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used" (Yin, 1994, p.13). Yin provides insight into when case studies should be implemented "...when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real life context" (p. 1). These definitions seem conducive with the current exploratory investigation. Case studies allow for the researcher to fully explore an issue/theory and may set the theoretical framework for future research with increased sample sizes.

Case studies can be investigated using various methodologies. The selected methodology for the current study was an alternating treatment design (ATD) which is used for comparing the effects of at least two interventions over brief periods of time (Barlow & Hersen, 1984). One of the major stipulations of using an alternating treatment design is that the two randomly alternating treatments/interventions need to be distinctly different. On the surface, imagery and video feedback may appear somewhat similar however, specific differences should be noted. Video is strictly a visual and auditory modality. However, (as discussed earlier) imagery incorporates not only visual images but tactile and auditory kinesthetic sensations as well. Further, imagery allows an individual to switch perspectives in the midst of the process, while the images shown on video are more uniform. Video is also limited by past experience. Only what has occurred can be shown, whereas imagery can be used in the creation of a task that has never been performed. Misinformation regarding visual imagery and vision (i.e.,

observation of a video) exist perhaps due to the similar pictorial nature of the interventions. Imagery and video have historically been used in combination to facilitate the formation of an image. This has led to the misconception as to how these processes function. Processing video feedback entails the employment of the visual sense and occurs in the primary visual cortex in the brain. Brain wave activity is more generalized during imagery use and has implicated the anterior supplementary motor area, the posterior inferior primary motor cortex, the cerebellum, the frontal lobe (basal ganglia), the anterior primary motor cortex, and the supplementary motor area (Magill, 1998). Through mapping of the brain it is evident that visually processing feedback and imaging an event are two distinct process which satisfies the criteria stipulated by the alternating treatment design.

The use of ATD in research. ATD designs have been typically used in educational settings to examine the relative effectiveness of different pedagogical techniques (e.g., Skinner, Hurst, Teeple, & Meadows, 2002) or with special needs children (e.g., Weismer & Murray-Branch, 1993). In a sport setting, Wolko, Hrycaiko, and Martin (1993) used an ATD to increase task behaviour of five young female Level 2 gymnasts (aged 10 to 13 years) on the balance beam. This study began with a 3-week baseline phase followed by an 8-week comparison phase. The design utilized three conditions: a baseline condition with standard coaching only, a treatment (T1) condition that combined elements of standard coaching with public self-regulation components, and a treatment (T2) condition that combined elements of standard coaching with private self-regulation components. The conditions were counterbalanced and occurred once during each week.

All three conditions demonstrated an increase in the percentage of attempted and completed skills from baseline. T2 revealed increased effectiveness for three of the five

participants. The T2 condition demonstrated the highest mean of attempts, completes, and percentage of completes. T2 produced an average of nine more attempted skills per practice than T1 and the baseline condition. The entire group of subjects produced an average of 10 more completed skills in T2 compared to the baseline condition (a 22% increase) and seven more than T1 (a 15% increase). One participant benefited most from T1.

Wolko et al. (1993) further explored their results through a social validation post measure. Four of the five subjects indicated that they did not like the baseline procedures (consisting of standard coaching). Participants felt that the self-regulation procedures used in both self-management packages increased their motivation to participate. All the participants enjoyed the reward opportunity and the graphed feedback.

Purpose

The purpose of the proposed study was to compare the immediate effectiveness of a cognitive general imagery versus strategic video feedback intervention program on the performance of three tactical plays of two intercollegiate hockey goaltenders.

Hypotheses

H_0: The imagery intervention will result in decreased or no changes in CG use from baseline

H_1: The imagery intervention will result in an increase in CG imagery use from baseline

H_0: The imagery intervention will result in a decrease or no change in performance from baseline

H_2: The imagery intervention will result in an increase in performance from baseline

H_0: The video feedback intervention will result in decreased or no changes in performance from

baseline

H_3: The video feedback intervention will result in an increase in performance from baseline

H_0: A difference in performance will be found between the imagery and video intervention

H_4: No difference in performance will be found between the imagery and video intervention

Significance of the Project

The purpose of this research was to examine the immediate effectiveness of strategic imagery versus video feedback on performance. Research investigating CG imagery is scant, which seems peculiar considering the successful execution of tactical plays can be pivotal for successful performance and practice. This void in the psychological skills training literature needs to be explored to facilitate the needs of athletes and coaches. The use of strategic imagery and video could help reinforce both strategy and team play. If an athlete habitually images the location of his/her teammates, he/she would be more likely to create a play (i.e., deflect the puck in the right position) and read plays, compared to the athlete who "tunnel" images himself/herself executing a specific skill. With the success of CS imagery for a motor skill, it would be reasonable to conclude that CG imagery would be an equally beneficial to strategy if employed.

To the researcher's knowledge, this would be the first study to distinguish which intervention was most influential on performance. Prior experiments have used video feedback as a means to enhance/construct an individual's imagery (e.g., Hall &

Erffmeyer, 1983). The combination of these two interventions does not provide researchers or coaches with a specific decisive effect of either intervention. The current dissection of the two interventions may pave the road for future exploration or may aid coaches in deciding which intervention has the most immediate effect for their team's/individual's performance.

This research serves to bridge the gap between sport psychology and advances in technology. The use of video (e.g., the Dartfish Inc) offers a unique opportunity for feedback. The Dartfish interactive software system may aid other researchers and coaches in the creation of qualitative and quantitative evaluation schemes of athletic performance. Dartfish can measure an individual's performance outcome (i.e., save percentage) while also enabling the observation and analysis of the acquisition.

The uniqueness of the ATD is another means by which this study differs from those found in sport psychology. Bryan (1987) advocated for the benefit of single subject designs in the empirical literature. To date, there is a paucity of published research employing these unique designs. Perhaps this research may educate other experts in the field to an alternative methods to test some of the pre-existing theories of sport psychology.

Methodology

Participants

Two male varsity hockey goaltenders aged 24 and 25 were asked to participate in the study. The participants had competed for their current university team for three years and both were right handed. Experience using imagery and video feedback was assessed through open-ended questions. Participant 1 "did not image very much" and reported

watching video feedback only four times prior to the intervention. Participant 2 demonstrated a much higher frequency of imagery and video use. The night before games Participant 2 "usually" imaged 24 or more times and watched video.

The time spent actually performing imagery differed between the two subjects. When engaging in imagery, Participant 1 stated his sessions lasted approximately 30 seconds, while Participant 2 engaged in imagery between 5-10 minutes per session. The goaltenders differed in their imagery perspective. Participants stated that video was used primarily for positioning and game situations. Participant 1 reported being an external imager, while Participant 2 was an internal imager.

Measures

Demographic questionnaire. Participants were asked to provide sport history information. The participants' prior employment of imagery and video were also assessed (see Appendix A).

Imagery ability. Hall and Martin (1997) developed the Movement Imagery Questionnaire-Revised (MIQ-R; see Appendix B) from the original MIQ (Hall & Pongrac, 1983). The MIQ-R is a shortened version of the MIQ. Other alterations to the MIQ-R centered around clarity of the wording and the reversal of the rating scale. The MIQ-R assessed both visual and kinesthetic imagery ability of movements. Each of the eight items involved the performance of an explicitly described motor movement. Participants are then directed to see (visual imagery) or feel (kinesthetic imagery) the movements without actually performing them and rate the ease in which they were able to construct the image on a 7-point Likert scale, where 1 = "very hard to see/feel" and 7 = "very easy to see/feel". An example of one the items is as follows. *Starting Position:*

Extend the arm of your non-dominant hand straight out to your side so that it is parallel to the ground, palm down. *Action:* Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly. *Mental Task:* Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Imagery scores for the visual and kinesthetic perspectives are calculated independently. Correlations between the MIQ and MIQ-R have been recorded at r = -.77, and -.77 for both visual and kinesthetic overall imagery ability (Hall & Martin, 1997). Cronbach's alpha has revealed acceptable reliability for the visual (.75) kinesthetic (.83) scales (Hall, 1998). Correlation between scales assessing visual and kinesthetic imagery were found to be .31 (Hall, 1998).

Imagery use. The Sport Imagery Questionnaire (SIQ; Hall et al., 1998) was administered to assess participants' frequency of cognitive and motivational imagery use (see Appendix C). This 31 item, self-report inventory asked participants to rate themselves on a 7-point Likert-type scale (1 = rarely, 7 = often) on how often they employed the five different functions of imagery. Examples of the items include: "I imagine being in control in difficult situations" (MG-M); "I imagine myself handling of the arousal and excitement associated with my sport" (MG-A); "I image others applauding my performance" (MS); "I imagine my skills improving" (CS); "I make up new plans/strategies in my head" (CG). Each subscale was used for independent comparison. The SIQ has demonstrated adequate structural and construct validity (Hall et al., 1998; 1997) with all items loading on their respective subscales above

recommended criteria. All scales have demonstrated acceptable internal consistencies, with Cronbach's alpha coefficients ranging from .75 to .89 (Hall et al., 1998). Furthermore inter-scale correlations range from -.31 to .22 which indicate that the subscales assess different constructs (Hall et al., 1998).

Performance measures. The performance measure was save percentage. This was calculated by dividing the number of saves made by the total number of shots on goal, and multiplied by 100. Save percentage was determined from all practices during the baseline and intervention phases. All practices were videotaped and save percentage was calculated from tactical plays that met the criteria for inclusion. For the purposes of this study only right point shots from a right shooting player were analyzed. A shot on goal consisted of any shot that went into the net, hit the goal post, cross bar, or was stopped by the goaltender (Rogerson & Hrycaiko, 2002).

Dartfish. The baseline measures (e.g., saves performed) were used in the formation of the ideal self-model constructed via the Dartfish software system (Dartfish, Inc.). Dartfish capabilities that were employed in this study were the clip editing and the Analyzer function. Clip editing consisted of shortening the lengths of clips, which provided the observer with only the desired play. The Analyzer function enabled the researcher to zoom in and out on some of the clips and to synchronize the defenseman's shots of the "ideal save" and those saves/trials performed during the intervention. The computer system was able to use footage from the baseline for a comparison of the "optimal/ideal" front and back save perspective with front and back perspective from the baseline in a four way split.

Manipulation check. Upon completion of the intervention, participants' views concerning imagery and video interventions were gathered. This was done to gain additional feedback and a measure of adherence to the intervention (see Appendix D).

Procedure

Prior to the creation of the research project an informal meeting between the varsity hockey coach, and the members of the research team occurred. This meeting was to discuss the feasibility of the project and to provide the coach with information regarding what would take place and what role he would play. It was agreed that the research would be noninvasive and that practices should run normally. Consequently, the creation of the practice was up to the coach and no special considerations were to be made for the research protocol.

During the discussion it was evident that the coach wished the goaltenders to be involved in the study. It was decided that only practices would be investigated due to the nature of the position. In hockey, most elite/varsity teams habitually employ one goaltender during the competitive season. Consequently, evaluating both goaltenders in a competitive situation would not be feasible. The research team agreed; three tactical plays were then conceptualized. The three tactical plays consisted of shots initiated from a right shooting defenceman from the blueline with either 1) no one in front, 2) an offensive player in front, or 3) an offensive player skating in for a pass. The coach assured the researchers that those three tactical plays were frequently occurring drills and strategies in the team's daily practice routine.

The coach was informed that there would be two video cameras taping performance and that minimal fraternizing with the team would occur. The coach's role

was 1) to offer suggestions as to what plays should be used in the intervention; 2) to analyze/rate the video clips during baseline to establish an "ideal"; 3) to assist in the development of specific performance measures; 4) to facilitate the development of the imagery; and 5) finally to evaluate performance during the intervention phase.

Once the Brock Ethics Board approved the study (see Appendix F) the coach was re-contacted. He was asked to complete the technical advisor consent form (see Appendix G). A tutorial was provided to the coach as to the tenents of the bioinformational theory (Lang, 1979; 1985). The coach was asked to transcribe the technical elements involved in an ideal save from the blueline on the three tactical scenarios. This information served in the creation of the imagery scripts. He was also asked to forward this information via email to an expert goaltending coach. The expert goaltending coach was contacted to ensure that the goaltenders received all the necessary technical aspects required in the formation of the ideal save from the blueline.

Upon completion of the above, two male varsity goaltenders were contacted to request participation in the study. The goaltenders were informed that this study was to investigate the effects of imagery and video feedback on performance. They were naive to the specific strategic nature of the investigation as to not interfere with the validity of the research. Preliminary information was provided and reinforced by a letter of information (see Appendix H) which the participants were asked to read. Once questions or concerns were addressed, participants were asked to read and complete an informed consent form (see Appendix I). Participants were then asked to complete the demographic questionnaire, the SIQ, and the MIQ-R individually in a quiet dressing room. Participants were informed of the necessity for honesty in their responses.

During this initial meeting participants were provided with background information on imagery. Imagery definitions (i.e., visual, kinesthetic, internal, and external) were provided to enhance participants' comprehension. Participants were also introduced to the bioinformational theory (Lang, 1979; 1985) and the three propositions necessary to develop a good imagery script. They were then asked to construct their own imagery script. The self-constructed imagery scripts were used to provide insight into the participants' different goaltending styles (i.e., stand up, butterfly, or a flopper). It also provided the researchers with cues/propositions that the individual goaltender adhered to. The goaltenders were provided with a detailed handout as a reminder to ensure the necessary elements of a good script were included (see Appendix J). This enabled participants to work on their three scripts at home.

Information gathered from the MIQ-R and SIQ, the self-constructed imagery script, and the specific performance measurements were used in combination with suggestions from the expert goalie coach, the varsity coach and the research team in the formation of individualized imagery scripts (see Appendix K). The scripts included a) no one in front of the net during the point shot, b) a forward in front of the net during the point shot, and c) an offensive player in motion coming towards the net.

Standardization phase. A standardization phase occurred over a three-week period. The standardization phase was designed to formalize the procedure for camera set up in the two practice arenas, camera magnification, and to get participants used to being videotaped to eliminate reactivity. During the baseline phase only camera magnification was modified.

Camera set-up. The study used two digital Panasonic Mini DV palm recorder 330x Digital High definition 200M 20x cameras, which were set up at one end of the arena. As such, only one goaltender could be videotaped at a time. The footage was recorded on Panasonic Mini DV Cassettes (LP mode 90 ME 60/90) and JVC High Quality Mini DV (60 ME 60/90) cassettes. The two cameras were positioned at a 40-degree angle creating a symmetrical front and back view of the goaltender. Camera 1 filmed the front of the goaltender, which permitted the analysis of the body position measures. Camera 2 was positioned behind the goaline in the left corner to allow for a complete view of the play. This angle enabled the researcher to gather data on angles, distances, and encompassed the incoming shot. During baseline, camera 1 was zoomed to a magnification of 3, while during the intervention the camera's magnification was 9. The research was performed in two arenas due to practice scheduling. The majority of baseline data were gathered in arena 1 while majority of the intervention data were gathered in arena 2 (see Appendix M).

Arena 1. Camera 1 was mounted on a 7-foot ladder with the neck of the Gruppo Manfrotto # 136 tripod fully extended at 2 feet. The camera was set up 2.5 feet behind the centerline (i.e., redline). To ensure consistent positioning hockey tape was used as a marker. Camera 2 was positioned on a tripod extended to 8 inches. Camera 2 was located on the wooden stands in the corner behind the goaline. Camera 2 was positioned at the same angle and height as camera 1. Camera 1 was zoomed to a magnification of 3 during the baseline and standardization phases. During the intervention phase, camera 1 was magnified to 9.

Arena 2. Camera 1 was located on the score keeper's table. It was not possible to mount the camera on the ladder due to space and safety concerns. Camera 2 was located on the first flat area on the stairs at a height of 20 feet. The camera was positioned at this height to compensate for the glare off the plexy glass. Camera 2 was zoomed at a magnification of 2. This resulted in a similar image to that in arena 1.

Baseline. Baseline data was gathered via videotape over a two-week period at all scheduled practices (approximately three practices per week). The participants' ability to execute the necessary skills/strategies needed for a save from a defenceman's point shot, which could potentially be tipped (i.e., redirected) by an offensive player were gathered. The first drill simply consisted of shots being taken from the blueline. The second drill was set up with the introduction of a puck to a defenceman who then decided on the position of the defensive and offensive players to either shoot or try and make a pass. The forward offensive player was introduced by either cutting in from the corner/wing for a quick deflection/pass or in front of the net for position. The third type of drill were game like drills. This consisted of power plays, face-off coverage, and offensive and defensive zone coverage. The goaltenders' ability to process the position of players and find the optimum position was gathered and used for the construction of the ideal self-model.

The varsity coach selected each goaltender's ideal save from the baseline data. He felt that the goaltender exhibited the proper positioning and tracking of the puck. The play itself was deemed to be a good representation of a point shot. A further benefit to the selection of this clip was that all the performance was clearly visible.

Comparison phase-imagery intervention. Information was provided on strategic imagery and how it could be applied to goaltending in hockey (i.e., angles). Any questions or concerns regarding imagery training were answered at this point. Imagery scripts tailored to each goalie's playing style and imagery perspective were then handed out. Participants were asked to read through the scripts three times to become familiar with the details and to ensure that all pertinent information was included. The participants were given the opportunity to modify the script at this juncture. Participants were asked to adhere to the written imagery scripts for the duration of the intervention. They were then asked to image each script five times in "real time" (i.e., the amount of time needed to physically perform the sequence). The participants were instructed to image or view video only the designated days (i.e., imagery or video feedback intervention) 10 minutes prior to the practice. They were asked to refrain from imagery during other instances during the practice.

Comparison phase-video intervention. Participants were provided with background information on the effectiveness of video analysis in hockey (i.e., Patrick Roy uses replays on the big screen monitors for positioning) and in other sports. Participants were privately shown their three ideal performances five times (n = 15) from their baseline measures via a VHS tape in the coach's office on a 29 inch screen. The participants first watched the front view followed by the back view in real time. Video clip scenarios were similar as those in the imagery scripts. Participants were made aware visually and by the researcher the reasons these clips were selected as ideal self-image. The ideal image exhibited proper position (as selected by their coach) in which they were to model future performances after.

On Ice Intervention. Depending upon condition, goaltenders were asked either to image or view via video, each one the three scenarios five consecutive times 10 minutes before stepping on the ice. This took place individually in a private, quiet dressing room. This enabled the researcher to examine the immediate effectiveness of the technique.

Study design

An alternating treatment design (ATD; Barlow & Hayes, 1979; Tawney & Gast, 1984) was employed, using imagery and video as the experimental conditions. Imagery and video feedback served as the independent variables, while performance and the SIQ were the dependent variables. The design includes three phases: (a) baseline; (b) comparison phase (rapidly alternating the two interventions); and if necessary (c) use of the better/best treatment alone. An intervention is judged to be the best when a consistent difference occurs in the level and/or trend of the data patterns (Tawney & Gast, 1984). The better-best treatment alone condition is typically employed when the design includes the presence/absence of a treatment (e.g., drug testing). For the purposes of this experiment only the baseline and comparison phases were employed. The random rapid alternating treatments controls for sequence effects (Barlow & Hersen, 1984; Ulman & Sulzer-Azaroff, 1975). The assumption is that using interventions for a brief time period, is less likely to produce learning history that results in sequence effects. This protocol has been researched as a means of reducing carryover (Chen, Wang, & Li, 2001).

Statistical analysis

Descriptive statistics were calculated on participants' SIQ scores to determine changes in the mean scores pre and post the imagery intervention. To examine the influence of the treatments on the participants' save percentages, calculations of save

percentages and visual inspection of the graphed data points were performed. This was performed separately for each participant. Visual inspection is a non-parametric technique investigated the trends of the data points which is often employed in case study designs (Wagner, 1992; Weber, & Hanna, 1998; Wilk, Fisher, & Gutierrez, 2000). An inference between the linear equation of the baseline, CG imagery and video feedback interventions were made.

Results

The original purpose of this study was to investigate the immediate effectiveness of imagery or video feedback training on three tactical plays in hockey. However, analysis will be presented for only one of the three plays as there were only limited (i.e., < 5) times the other plays developed. Consequently, informative conclusions could not be communicated. During the intervention phase, the drill with one man in front was the only drill which occurred with an acceptable amount of trials for analysis.

Participant 1

Manipulation check. The manipulation check demonstrated that Participant 1 adhered to the interventions and felt both had a positive effect. He imaged the scenarios and watched video clips every second day as stipulated by the researcher. The post intervention questionnaire revealed that Participant 1 perceived that he benefited more from the video than the imagery intervention. Participant 1 thought that it was beneficial to see success and also to have a different view of the play developing. He noted that his confidence was high going into the study and the interventions did nothing to diminish his confidence. He further added that the study made him look at the little things that he normally overlooked.

Imagery ability. The MIQ-R was administered to determine imagery ability and perspective. Participant 1 demonstrated adequate MIQ-R mean scores (i.e., > 16) for visual and kinesthetic imagery, consequently no supplementary imagery training was necessary (Hall & Martin, 1997). Participant 1 scored 23 out of a possible 28 on the kinesthetic scale and 24 out of 28 on the visual scale. As such, Participant 1 employed both imagery perspectives with relatively equal proficiency at a moderately high imagery ability.

Frequency of imagery use. Descriptive statistics were calculated, pre-and post-intervention across the five functions of imagery (see Table 1). Due to the nature of the design, significant differences pre-post intervention could not be calculated. Pre-intervention, Participant 1 reported low to moderate frequency scores across the five functions. An examination of pre-post test means demonstrated an increase in the utilization of all five functions of imagery. CG imagery was of particular interest to the present investigation. Participant 1 reported a pre-intervention mean score across this dimension of 3.00. Upon completion of the study, Participant 1 reported a minimal increase (i.e., 0.17) in the use of strategic imagery.

Performance. Performance was operationalized as the save percentage (see Tables 2 and 3). It was hypothesized that both the imagery and video feedback intervention would result in improved performance from baseline. No specific hypothesis concerning which of the two interventions would be better was offered. Participant 1 demonstrated an overall save percentage of 81.18% during the baseline phase with scores ranging from 66.67% to 100.00%. The save percentage calculated across each of the four imagery intervention days was 100.00%. Save percentage across

the three video intervention days were 78.57% with scores ranging from 60.00% to 100.00%.

Visual inspection revealed a steady increase across the baseline phase and stability was achieved on sessions 10-12 with a 100% save percentage (see Figure 1). This extended into the intervention phase. It was observed that the imagery intervention produced a consistent save percentage of 100% across all four sessions. Consequently research hypothesis two was supported.

Research hypothesis three was not supported. The first day of the video intervention, the save percentage remained consistent with the final two days of baseline (100%). Subsequent video feedback sessions resulted in a substantial drop in save percentage (75% and 60% respectively). The final video intervention day witnessed a return to a perfect save percentage. Fatigue may have been a contributing factor during these two sessions. The visual inspection led the researcher to conclude that the imagery intervention was the far superior intervention for Participant 1's save percentage.

Hypothesis four examined the difference between an imagery and video feedback intervention. Improvements in performance were made for both the imagery and video feedback interventions. However, performance was superior during the imagery intervention in comparison to feedback both in overall save percentage and consistency of performance. As a result, it can be concluded that imagery had a greater immediate effect on performance.

Participant 2

Manipulation check. The manipulation check demonstrated that Participant 2 adhered to the interventions and felt they had a positive effect. He imaged the scenarios

and watched video clips every second day as requested. Participant 2 perceived that he benefited more from the video than the imagery intervention. Participant 2 noted that the video enabled him to view how he challenged the shooter, which he felt added to his development.

Imagery ability. The MIQ-R was administered to determine imagery ability and perspective. Adequate MIQ-R mean scores (i.e., > 16) for visual and kinesthetic imagery ability were demonstrated. Participant 2 scored 19 out of 28 on the kinesthetic scale and 26 out of 28 on the visual scale. Based on the above scores, Participant 2 was categorized as a more proficient visual imager.

Frequency of imagery use. Descriptive statistics were calculated pre-and post-intervention across the five functions of imagery (see Table 1). Due to the nature of the design, significant differences pre-post intervention could not be calculated. Pre-intervention, Participant 2 reported moderately high frequency scores across the five functions. An examination of pre-post test means demonstrated an increase in the utilization of four of the five functions for Participant 2 with MG-M imagery decreasing post-intervention. CG imagery was of particular interest to the present investigation. Participant 2 reported a pre-intervention mean score across this dimension of 4.00. Upon completion of the study, Participant 2 reported an increased use of strategic imagery with a score of 4.33.

Performance. Performance was operationalized as the save percentage (see Tables 2 and 3). It was hypothesized that both the imagery and video feedback intervention would result in improved performance from baseline. Participant 2 recorded an overall save percentage during baseline of 64.29% with scores ranging from 62.50%

to 100.00%. During the imagery intervention, save percentage increased to an overall mean of 84.62% with scores ranging from a low of 66.67% and a high of 100.00%. For the video intervention, the overall save percentage recorded was 88.89% with scores ranging from 75.00% to 100.00%.

Visual inspection revealed a steady increase in the performance across the baseline period with the final session recording a save percentage of 100% (see Figure 2). Performance decreased to 67% on the first imagery intervention session. The final three imagery sessions resulted in all shots being stopped for a save percentage of 100%. Consequently, research hypothesis 2 was supported.

Research hypothesis 3 stated that the video intervention would result in improved immediate performance following baseline. This hypothesis was supported. The first day of the video intervention, the save percentage remained consistent with the final baseline session (100%). The subsequent video feedback session resulted in a drop in save percentage (75%). The final video feedback session resulted in a return to a perfect save percentage.

Research hypothesis four was offered to examine whether imagery or video feedback training was more beneficial to immediate performance. Based on consistency of performance, the imagery intervention was more beneficial than was the video intervention. Three of four imagery training sessions resulted in a perfect save percentage, whereas two of the three video intervention sessions resulted in a save percentage of 100%.

Discussion

Coaches and athletes are continuously searching for strategies to improve performance. Within the last few decades a heavier emphasis has been put on the mental aspect of sport, due in part to athlete testimonials, research, and the rise of the field of sport psychology. Two of the most predominantly used techniques espoused to facilitate performance are imagery and video feedback (Weinberg, 1982). Imagery has been identified as the most frequently used mental skill (Martin et al., 1999) and coaches spend hours observing game footage trying to exploit weaknesses of opposing teams/players and in the facilitation of teaching new skills and strategies. Numerous studies have demonstrated the beneficial effect of imagery on performance (Hall et al., 1994; Munroe et al., 2000) however only a small number of studies have investigated the use of CG imagery (Fenker & Lambiotte, 1987; Rushall, 1988; Moran % MacIntyre, 1998; Munroe et al., 2003). According to the tenants of the symbolic learning theory (Sackett, 1934; 1935) strategic imagery use should surpass the benefits of CS imagery due to the cognitive complexity of the task. A scant amount of research has utilized video as a performance-enhancing tool for imagery, which has undoubtedly added to the confusion as to the distinctiveness of these two the cognitive processes. The current investigation was conducted to examine the immediate effectiveness of imagery vs. video feedback on performance.

The manipulation check measured the participants' adherence to the study and their views in general regarding the intervention. Both participants complied with the provided imagery scripts and did the interventions on the specific days requested. Participant 1 and 2 felt that they benefited more from the video intervention. This may be

due to video feedback being a more tangible tool/process. The social cognitive theory (Bandura, 1986) and self-modeling theory (Dowrick, 1999) may provide some insight into the participants responses. Both theories have deep roots with self-efficacy and it's effect on behaviour and performance. Self-efficacy theory states that an individual has confidence in his/her ability to do things that he/she tries to do (Bandura, 1986). During observation of the video clips the participants viewed themselves successfully executing the correct elements of a save. This may have provided the athletes with a sense of accomplishment and increased confidence in their ability, which perhaps transcended into higher levels of self-efficacy. The selection of the clips by the coach may have also been an influencing factor to choosing video as their preferred modality. This allowed for the athletes to view an ideal self-model as selected by the coach rather then one fabricated in their mind. Perhaps this allowed the participants to gage important elements as deemed by the coach which resulted in more positive feedback from the coach in practice. The participants may have also had a preconceived notion that video feedback would be more beneficial since it is predominantly widespread through professional sport. An individual is more likely to hear an athlete comment on the hours of game footage they observed compared to the hours in which they imaged the event. Further, the other members of the team had video feedback sessions with the coach and no imagery sessions. This too may have also ingrained the importance of video to the participants. They both proclaimed to have enjoyed and benefited from the study.

The first research question addressed whether an imagery intervention would result in changes in the frequency of imagery use. The intervention did produce a small increase of CG use for both participants. The minimal difference was surprising

considering the effort put forth to clarify the issue and the heavy emphasis put on CG imagery in the imagery scripts. There was more growth in CS imagery pre-post intervention.

Difference scores were calculated across the other functions of imagery pre-post intervention. It may be that imagery training specific to one function may influence imagery use across others. Participant 1 reported the greatest improvements in frequency of imagery use across two motivational functions MS (2.00 to 3.00) and MG-A (2.0 to 3.33). Frequency of imagery use increased from low to moderate levels post-intervention.

Participant 2 reported using imagery more frequently across almost all dimensions. Participant 2 demonstrated the greatest increases in CS and CG imagery, which would be consistent with the intent of the intervention. The CS imagery showed the most dramatic increase from 4.14 to 5.00, while improvements in CG were lower (i.e., 4.00 to 4.33). MG-A and MS imagery demonstrated identical initial scores and increases (i.e., 4.00 to 4.17). An interesting effect of the intervention was observed in MG-M (i.e., 4.67 to 4.50).

This phenomena was unexpected as no emphasis was put on reducing or inducing either of these functions. The imagery script did however use numerous arousal regulation words such as "relax" and "focus". The employment of these words could have been a contributing factor to the MG-A function increases. This finding supports that by Munroe et al. (2003) which examined CG imagery with youth soccer players. Post-intervention, increases in MG-A imagery also resulted. The explanation provided by the author was that athletes may use this type of imagery in order to increase or decrease

arousal levels prior to executing a strategy. This may be true for goaltenders in hockey since they need to be at a peak arousal level in order to make a save. The final analysis revealed that Participant 1 reported increases in the frequency of imagery use post-intervention.

The final analysis revealed that both participants reported increases in the frequency of imagery use post-intervention with the exception of MG-M for Participant 2. The magnitude was greater for Participant 1 than Participant 2. This may be a reflection of baseline scores. Consequently a ceiling effect may have influenced changes in imagery use for Participant 2. For Participant 1, more room for improvement existed pre-intervention.

A unique aspect of this research was the use of the goaltenders in the creation of the imagery script. This joint union helped the researchers to delve deeper into the perceptual cues to which the goaltenders attended. Speculated evidence to this effect was observed in the differences in performance between Participant 1 and 2. Participant 1 produced a more detailed and lengthy script to the researcher than did Participant 2. The final script sizes were adjusted by the researcher to be similar, however Participant 1 had more individualized specific cues in his script. This perhaps may have been the reason Participant 1 demonstrated more gains from the imagery intervention than the video intervention. Further Participant 1 demonstrated a more consistent rating across visual and kinesthetic imagery ability while showing a lower frequency of use. Perhaps the intervention was most beneficial for Participant 1 because he had uniform imagery ability and more room for improvement due to the lack of imagery use prior to participation in the study.

It was hypothesized that CG imagery training would result in immediate improvement on performance. This hypothesis was supported Participant 1 demonstrated by far the greatest gains in save percentage during the imagery intervention. No goals were tabulated during the perfect save percentage acquired during the imagery intervention. While perfect save percentage was recorded during baseline, consistency in this measure was not evident. During the intervention phase consistency was demonstrated. Imagery training may have contributed to this finding. Participant 2 demonstrated a lower baseline than Participant 1 and also encountered inconsistency during the baseline phase. Participant 2 initial imagery intervention was consistent in the range of his baseline scores. Following the first intervention Participant 2 achieved a consistent incline which plateaued to a perfect save percentage. The superior performance and consistency was demonstrated by Participant 1 over Participant 2 may again have been a function of imagery ability. Martin et al., (1999) suggested that imagery ability moderates outcomes. As such, those with greater imagery ability demonstrate greater benefits from imagery use. The results of this research corresponded to a study conducted by McFadden (1981). McFadden concluded that imagery was an effective tool in improving hockey goaltenders' performance and offered the following explanations to support his findings

1) Imagery rehearsal mobilizes positive expectations that an athlete will perform well. Successfully stopping shots in one's mind prior to facing a motor task increases one's confidence that he/she will perform well in real life.

> 2) Imagery rehearsal allows an athlete to pre-prime or program the brain to make quick, efficient decisions in response to a stimulus. Consequently, goaltenders were able to react quickly and without hesitation in response to shots (p. 100).

It was hypothesized that video feedback training would positively influence immediate performance. This hypothesis was partially supported. Save percentage for Participant 1 decreased an average of 2.61% following video intervention, whereas it increased for an average of 24.60% Participant 2. The immediate effectiveness of video feedback adversely effected performance of Participant 1 perhaps due to his lack of experience utilizing the technology as reported in the demographic questionnaire. This could have been in part due to concentrating on that specific shot from the video which did not allow for any manipulation as in the case of imagery. Engaging in imagery may produce greater plasticity than a video image. Video feedback may have been too for Participant 1 may have acted too much like a stencil or template in which acted as a stringent cueing effect with an expected outcome. With the variation in the shot this may have caused delays or incorrect motor movement due to the mental video imprint of the play. The demographic questionnaire for Participant 1 indicated that he had more experience imagining than viewing video. Replaying performance over in his head (i.e., imaging) may be a more comfortable modality for him to view performance.

A difference was observed between the two interventions. Through the visual inspection of data, imagery was deemed to have the greatest effect on performance. Further imagery revealed to be the most consistent of the two intervention. Participant 1 save percentage remained at perfect save percentage throughout the intervention. Participant 2 initial imagery intervention was substantially lower however, dramatically

increased and remained constant. A negative relationship existed between imagery and video feedback for Participant 1. Video feedback had an adverse effected on performance for Participant 1. Participant 2's video feedback intervention deviated from the perfect save percentage in the middle of the intervention.

Limitations

As with most applied work, limitations can be identified which may have affected the outcome. Some of the limiting constraints were in the researchers' control while others were not. The major limiting themes were: time delays, lack of trials, and technical obstacles.

A major research constraint centered on the timing of the intervention. An ATD is a continuous design. Major breaks during any phase are not recommended. The design investigates the immediate effectiveness of the intervention thus a break would severely affect the results that could be drawn. Following proposal and ethics review board delays the study would have been interrupted by the university examination period, Christmas break and a New Year's tournament. These delays totaled approximately 4 weeks. Consequently baseline data could not be gathered until the team returned to their regular practice schedules. This left approximately 7 weeks in the season. Due to changes in scheduling the researcher needed to rely on the team doing well in the playoffs to further the intervention. Time delays were also evidenced from the expert goalie coach and the participants themselves in returning the imagery scripts. The final limiting theme occurred on the ice. On a few occasions the practices were not geared towards goaltender involvement and consisted of skating drills or practices being cancelled.

The second facet of the study shared a similar problem as the Munroe et al. (2003) research. Both studies were unable to gather sufficient data for the three tactical plays, which were to be investigated. Like Munroe et al., only one of the three plays were used for video analysis. Alterations in design are a definite limitation to the study of strategy in sport psychology.

One of the innovative features of this experiment was utilizing technology in sport psychology. Technical difficulties arose through lack of access to enough cameras. Access to two cameras allowed for only one goalie to be videotaped at a time, whereas they trained simultaneously at opposite ends of the arena. Often the goaltenders were practicing the drills simultaneously but at opposite ends of the arena. Consequently relevant data would be generated in all instances.

During the video analysis the coach mentioned that the time during the practice that the drill occurred was a definite factor on performance. Goaltending is unlike any other position in hockey. During warm up goaltenders are not that concerned with positioning; their sole objective is to get a feel for the puck on their body, while other goaltending drills are very structured which makes them follow specific paths to track the puck.

The lack of a pilot study was a definite limitation. A pilot study would have allowed for all the experimental glitches to be refined, such as camera location and magnification. The pilot study would have also provided the researcher with an opportunity to become more acquainted with the technology. Further, a pilot study would have insured that the three tactical plays selected were frequently occurring drills in the practice.

Future Directions

Despite limitations, a plethora of future experiments have been cognized to advance this line of research. If the current study were to be conducted again certain adaptations would have to be made. A minimum of two cameras located at each end of the arena would be needed. This would definitely increase the number of video recorded trials.

A technical adjustment would be that the magnification of the cameras would be completely set during the standardization protocol. Given that practices were held in two arenas this was impossible.

Members of the research team agreed to minimize invasiveness on practice. As such, the goaltenders were asked to image or view video clips approximately 10 minutes prior to practice. The time between the intervention and physical play of the tactic on the ice varied. To more fully assess the immediate effectiveness of each intervention, future researchers may want to include more structure in the timing of the actual performance of the drill. This would allow the intervention to be administered immediately prior to the development of the play, thus removing time of the drill as a limiting variable.

To aid future experiments with this type of an activity, perhaps more invasive stringent guidelines should be taken on the shooter. A technique that could be used would be to have marks on the ice (i.e., forming a box) where the player would have to shoot from. This would provide a visual guide and perhaps may curtail some of the cheating in the drills. This increased number of shots could also lead to a shot inventory. Thus similar shots could be grouped together and modified versions of the imagery script and video could be created.

One limitation of employing a case study design is that the results are not generalizable beyond the participants. One way to increase the number would be to perform the intervention at a goaltending camp. This would allow for a sample size of at least 30, which would allow for inferential statistics to be run.

The alternating treatment design requires treatments to be changed on a daily basis. Inter changing treatment on a weekly basis may help in the acquisition and learning of proper imagery and video viewing techniques.

The current section has solely concentrated on improvement to goaltender studies. Other investigations into strategies are surely warranted to help shed some light on the development and learning of strategies. The implementation of this type of intervention would undoubtedly show improvements in a team's ability to create plays (e.g., breakout, offensive attack). The idea of comparing imagery versus video is not solely a hockey-specific intervention. Further research needs to be conducted to create a pool of knowledge in which coaches can draw from in order to help improve performance.

Conclusion

The employment of a CG imagery program did increase the participants' CG imagery use. The CG imagery program further impacted the other functions of imagery predominately in a positive manner. The use of CG imagery was beneficial to participants' performance. This relatively unexplored facet of imagery does warrant further investigation. Video feedback provided different outcomes for the two individuals. The use of video feedback had a negative impact on Participant 1 while facilitating performance for Participant 2. This result would indicate that it is important for sport psychologists, coaches, and athletes to investigate if video is a positive or

negative tool for individuals. To the knowledge of the researcher this was the first study to investigate the difference between imagery and video feedback through an ATD. Further investigation with these two interventions and designs are needed.

References

Abernethy, B. (1996). Training the visual-perceptual skills of athletes. Insight from the study of motor expertise. *American Journal of Sport Medicine, 24*, 89-92.

Abma, C. L., Fry, M. D., Li, Y., & Relyea, G. (2002). Differences in imagery content and imagery ability between high and low confident track and field athletes. *Journal of Applied Sport Psychology, 14,* 67-75.

Anderson, M. P. (1981). Assessment of imaginal processes: Approaches and issues. In T.V. Merluzzi, C. R. Glass, & M. Genest (Eds.), *Cognitive Assessment* (pp. 149-187). New York: Guilford Press.

Bandura, A. (1986). *Social foundations of thoughts and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Barlow, D. H., & Hayes, S. C. (1979). Alternating treatments design: One strategy for comparing the effects of two treatments in a single subject. *Journal of Applied Behavior Analysis, 12,* 199-210.

Barlow, D. H., & Hersen, M. (1984). *Single Case Experimental Designs. Strategies for Studying Behaviour Change 2nd edn.* Pergamon Press, New York.

Barr, K., & Hall, C. R. (1992). The use of imagery by rowers. *International Journal of Sport Psychology, 23*, 243-261.

Bird, A. M., Ross, D., & Laguna, P. L. (1983). The observational learning of a timing task. *ERIC,* 269-370.

Blandin, Y., & Proteau, L. (1994). The effects of a model's level of performance on observational learning. *Proceedings of the North American Society for the Psychology of Sport and Physical Activity, 16*, 32-43.

Burhans, R. S., Richman, C. L., & Bergey, D. B. (1988). Mental imagery training: Effects on running speed performance. *International Journal of Sport Psychology, 19*, 26-37.

Bryan, A. (1987). Single-subject designs for evaluation of sport psychology interventions. *The Sport Psychologist, 1,* 283-292.

Callow, N., & Hardy, L. (2001). Types of imagery associated with sport confidence in netball players of varying skill levels. *Journal of Applied Sport Psychology, 13,* 1-17.

Callow, N., Hardy, L., & Hall, C. (1998). The effect of a motivational-mastery imagery intervention on the sport confidence of three elite badminton players. *Journal of Applied Sport Psychology, 10,* 135-147.

Cancio, L. C. (1991). Stress and trance in free-fall parachuting: A pilot study. *American Journal of Clinical Hypnosis 33*, 225-234.

Chen, C. M., Wang, H. P, & Li, T. Y. (2001). *A study on the design and evaluation of a Chinese alternative keyboard for individuals with disabilities*. Unpublished Manuscript. National Chiayi University, China.

Corbin, C. B. (1972). Mental practice. In W. P. Morgan (Ed.), *Ergogenic aids and muscular performance*. New York: Academic Press.

Denis, M. (1985). Visual imagery and the use of mental practice in the development of motor skills. *Canadian Journal of Applied Sport Science, 10*, 4-16.

Dorfman, H. A., & Kuehl, K. (1989). *The mental game of baseball: A guide to peak performance.* Diamond Communications, Incorporated.

Dowrick, P. W. (1999). A review of self modeling and related interventions. *Applied & Preventive Psychology, 8*, 23-39.

Driskell, J. E., Copper, C., & Moran, A. (1994). Does mental practice enhance performance? *Journal of Applied Psychology, 79*, 481-491.

Epstein, M. L. (1980). The relationship of mental imagery and mental rehearsal to performance of a motor task. *Journal of Sport Psychology, 2*, 211-220.

Feltz, D. (1976). *Effects of observer sex and informational motivational components of model's demonstration on motor performance.* Unpublished Master's Thesis Pennsylvania State University.

Feltz, D. L., & Landers, D. M. (1983). The effects of mental practice on motor skill learning and performance: A meta-analysis. *Journal of Sport Psychology, 5*, 25-57.

Feltz, D. L., & Riessinger, C. A. (1990). Effects of in vivo emotive imagery and performance feedback on self-efficacy and muscular endurance. *Journal of Sport & Exercise Psychology, 12,* 132-143.

Fenker, R. M., & Lambiotte, J. G. (1987). A performance enhancement program for a college football team: One incredible season. *The Sport Psychologist, 1,* 224-236.

Finsterbusch, K., & Mortz, A. B. (1980). *Social research for policy decisions.* Belmount, CA: Wadsworth.

Fitts, P. M., & Posner, M. J. (1967). *Human performance.* Belmont, CA: Brooke/Cole.

Flanders, J. P. (1968). A review of research on imitative behavior. *Psychology Bulletin, 5,* 316-337.

Franks, I. M., & Miller, G. (1986). Eyewitness testimony in sport. *Journal of Sport Behavior, 9*, 39-45.

Freeman, H. (1983). *Applied sociology*. San Francisco: Jossey-Bass.

Furlong, W. (1979). Coping, the power of imagination. *Quest*, 95-96.

Gipson, M., Mckenzie, T., & Lowe, S. (1989). The sport psychology program of the USA women's national volleyball team. *The Sport Psychologist, 3*, 330-339.

Glisky, M. L., Williams, J. M., & Kihlstrom, J. F. (1996). Internal and external mental imagery perspectives and performance on two tasks. *Journal of Sport Behavior, 19,* 3-18.

Goss, S., Hall, C., Buckholz, E., & Fishburne, G. (1986). Imagery ability and the acquisition of retention of movements. *Memory and Cognition, 14,* 469-477.

Grau, S., Baur, H., & Horstmann, T. (2003). Pronation in sport shoe research. *Deutche Zeitschrift fuer Sportmedizin, 54,*17-24.

Guadagnoli, M, Holcomb, W, & Davis, M. (2002). The efficacy of video feedback for learning the golf swing. *Journal of Sport Science, 20*, 615-622.

Hale, B. D. (1982). The effects of internal and external imagery on muscular and ocular concomitants. *Journal of Sport Psychology, 4*, 379-387.

Hall, C. R. (1995). The motivational function of mental imagery for participation in sport and exercise. In J. Annett, B. Cripps, & H. Steinberg (Eds.). *Exercise addiction: Motivation for participation in sport and exercise* (pp. 17-23).

Hall, C. R. (1998). Imagery. In Joan L Duda (ed.). Advances in Sport & Exercise Psychology Measurement (pp. 205-225). Morgantown, W.V.: Fitness Information Technology.

Hall, C. R., Buckolz, E., Fishburne, G. J. (1992). Imagery and the acquisition of motor skills. *Canadian Journal of Sport Sciences, 17,* 19-27.

Hall, C. R., Mack, D., Paivio, A., & Hausenblas, H. A. (1998). Imagery use by athletes: Development of the Sport Imagery Questionnaire. *International Journal of Sport Psychology, 29*, 73-89.

Hall, C. R., & Martin, K. A. (1997). Measuring movement imagery abilities: A revision of the movement imagery questionnaire. *Journal of Mental Imagery, 21,* 143-154.

Hall, C. R., & Martin, K. A. (1997). Situational and intrapersonal moderators of sport competition state anxiety. *Journal of Sport Behavior 20,* 435-446.

Hall, C. R., Rogers, W. M., & Barr, K. A., (1990). The use of imagery by athletes in selected sports. *The Sport Psychologist, 4*, 1-10.

Hall, C. R., Schmidt, D., Durand, M., & Buckolz, E. (1994). Imagery and motor skills acquisition. *Imagery in Sport and Physical Performance, 4,* 121-134.

Hall, E. G., & Erffmeyer, E. S. (1983). The effect of visuomotor behavior rehearsal with videotape modeling on free throw accuracy. *Journal of Sport Psychology, 5*, 343-346.

Halliwell, W. (1990). Providing sport psychology consulting services in professional hockey. *The Sport Psychologist, 4,* 369-377.

Hardy, L. (1997). The Coleman Roberts Griffith address: Three myths about applied consulting work. *Journal of Applied Sport Psychology, 9*, 277-296.

Hardy, L., & Callow, N. (1999). Efficacy of external and internal visual imagery perspectives for the enhancement of performance of tasks in which form is

important. *Journal of Sport & Exercise Psychology, 21*, 95-112.

Harris, D. V., & Robinson, W. J. (1986). The effects of skill level on EMG activity during internal and external imagery. *Journal of Sport Psychology, 8*, 105-111.

Hecker, J. E., & Kaczor, L. M. (1988). Application of imagery theory to sport psychology: Some preliminary findings. *Journal of Sport & Exercise Psychology, 10*, 363-373.

Helsen, W. F., & Starkes, J. L. (1999). A multidimensional approach to skilled perception and performance in sport. *Applied Cognitive Psychology, 13*, 1-27.

Highlen, P. S., & Bennett, B. B. (1979). Psychological characteristics of successful and non-successful elite wrestlers: An exploratory study. *Journal of Sport Psychology, 1*, 123-137.

Highlen, P. S., & Bennett, B. B. (1983). Elite divers and wrestlers: A comparison between open and closed-skill athletes. *Journal of Sport Psychology, 5*, 390-409.

Hird, J., Landers, D., Thomas, J., & Horan, J. (1991). Physical practice is superior to mental practice in enhancing cognitive and motor task performance. *Journal of Exercise & Sport Psychology, 13*, 281-293.

Isaac, A. R. (1992). Mental practice: Does it work in the field? *The Sport Psychologist, 6*, 192-198.

Ives, J. C., Straub, W. F., & Shelly, G. A. (2002). Enhancing athletic performance using digital video in consulting. *Journal of Applied Sport Psychology, 14*, 237-235.

Jacobson, R. (1932). Electrophysiology of mental activities. *American Journal of Psychology, 44,* 677-694.

Jones, L., & Stuth, G. (1997). The uses of mental imagery in athletics: An overview. *Applied and Preventative Psychology, 6,* 101-115.

Kosslyn, S. M. (1990). *Mental imagery.* In Osherson, D., N., Kosslyn, S. M., & Hollerbach, J. M. (Eds.), *Visual cognition and action* (Vol. 2). Cambridge, MA: MIT Press.

Landers, D. M., & Landers, D. M. (1973). Teacher versus peer models: Effects of model's presence and performance level on motor behavior. *Journal of Motor Behavior, 5,* 129-139.

Lang, P. J. (1977). Imagery in therapy: An information processing analysis of fear. *Behavior Therapy, 8,* 862-886.

Lang, P. J. (1979). A bio-informational theory of emotional imagery. *Psychophysiology, 16,* 495-512.

Lang, P. J. (1985). *The cognitive psychophysiology of emotion: Fear and anxiety.* In A. H. Tuma & J. D. Maser (Eds.), Anxiety and the anxiety disorders (pp.131-170). Hillsdale, NJ: Erlbaum.

Lang, P. J., Kozak, M., J. Miller, G. A., Levin, D. N., & McLean, Jr. A. (1980). A emotional imagery: Conceptual structure and pattern of somato-visceral response. *Psychophysiology, 17,* 179-192.

Lang, P. J., Levin, D. N., Miller, G. A., & Kozak, M. J. (1983). Fear behavior, fear imagery, and the psychophysiology of emotion: The problem of affective response integration. *Journal of Abnormal Psychology, 92,* 276-306.

Lariviere, G., & Lamontagene, M. (1981). Skill evaluation of ice-hockey goalkeepers.

In Proceedings of the third International Conference on the Coaching Aspects of Ice Hockey. International Ice Hockey Federation, 1-21

Lazarus, A. (1977). *In the mind's eye.* New York: Lawson.

Lazarus, R. S. (1991). *Emotional and adaptation.* Oxford: Oxford University Press.

Lerda, R., & Cardelli, C. (2003). Breathing and propelling in crawl as a function of skill and swim velocity. *International Journal of Sports Medicine, 24*, 75-80.

Levin, D. N., Cook, E. W., & Lang, P. J. (1982). Fear imagery and fear behavior: Psychophysiological analysis of clients receiving treatment for anxiety disorders. *Psychophysiology, 19,* 571-572.

Lohr, B. A., & Scogin, F. (1998). Effects of self-administered visuo-motor behavioral rehearsal on sport performance of collegiate athletes. *Journal of Sport Behavior, 21,* 206-218.

MacIntyre, T., & Moran, A. (1996). Imagery use among canoeists: A worldwide survey of novice, intermediate, and elite slalomists. *Journal of Applied Sport Psychology, 8,* 132-143.

Madigan, R., Frey, R. D., Matlock, T. S. (1992). Cognitive strategies of university athletes. *Canadian Journal of Sport, 17,* 135-140.

Magill, R. A. (1998). *Motor learning: Concept & applications.* McGrow-Hill: Boston, MA.

Mahoney, M. J., & Avener, M. (1977). Psychology of the elite athlete: An exploratory study. *Cognitive Therapy and Research, 1,*135-141.

Martin, K. A., & Hall, C. R. (1995). Using mental imagery to enhance intrinsic motivation. *Journal of Sport & Exercise Psychology, 17,* 54-69.

Martin, K., Moritz, S. E., & Hall C. R. (1999). Imagery use in sport: A literature review and applied model. *The Sport Psychologist, 13,* 245-268.

McFadden, S. (1981). *An imagery intervention for hockey goaltenders.* World Sport Psychology Congress 5th. Ottawa, On.

McGarry, T., & Franks, I. M. (1996). In search of invariant athletic behavior in sport: An example from championship squash match play. *Journal of Sport Sciences, 14,* 445-456.

McGinnis, P. M. (2000). Video technology for coaches. *Track Coach, 152*, 4857-4862.

Meyers, A. W., Cooks, C. J., Cullen J., & Liles, L. (1979). Psychological aspects of athletic competitors: A replication across sports. *Cognitive Therapy and Research, 3,* 361-366.

Miller, G. A., Levin, D. N., Kozak, M. J., Cook, E. W., McLean, A., & Lang, P. J. (1986). *Emotional imagery: Effects of individual differences in perceptual imagery on physiological response.* Unpublished manuscript.

Minas, S. C. (1980). Acquisition of a motor skill following guided mental and physical practice. *Journal of Human Movement Studies 6*, 127-141.

Moritz, S. E., Hall, C. R., Martin, K. A., & Vadocz, E. (1996). What are confident athletes imaging? An examination of image content. *The Sport Psychologist, 10,* 171-179.

Munroe, K. J., Giacobbi, P. R., Hall, C., & Weinberg, R. (2000). The four W's of imagery use: Where, when, why and what. *The Sport Psychologist, 14,* 32-48.

Munroe, K. J., Hall, C. R., Fishburne, G., & Shannon, V. (2003). *Using cognitive general imagery to improve soccer strategies*. Unpublished manuscript, University of Windsor, Canada.

Munroe, K. J., Hall, C. R., Simms, S., & Weinberg, R. S. (1998). Athletes' use of imagery early and late in their competitive season. *The Sport Psychologist, 12,* 440-449.

Mumford, B., & Hall, C. R. (1985). The effects of internal and external imagery on performing figures in figure skating. *The Canadian Journal of Applied Sport Sciences, 10,* 171-177.

Murphy, S. M., & Jowdy, D. P. (1992). *Imagery and mental practice.* In T.S. Horn (Ed.), Advances in sport psychology (pp. 221-250). Champaign, IL: Human Kinetics.

Murphy S. M., Jowdy, D. P., & Durtshi, S. K. (1989). *Report on the United States Olympic Committee survey on imagery use in sport: 1989.* Colorado Springs, CO: U.S. Olympic Training Center.

Noel, R. C. (1980). The effect of visuo-motor behavioral rehearsal training on tennis service performance. *Journal of Sport Psychology, 2,* 3, 221-226.

Orlick, T. (1986). *Psyching for sport: Mental training for athletes.* Champaign IL: Human Kinetics.

Orlick, T. (1990). *In pursuit of excellence (2nd ed.).* Champaign, IL: Leisure Press.

Orlick, T., & Partington, J. (1988) Mental links to excellence. *The Sport Psychologist, 2,* 105-130.

Paivio, A. (1971). *Imagery and verbal processes.* Holt, Rinehart and Winston. New York.

Paivio, A. (1986). *Mental Representations*. New York: Oxford University Press.

Paivio, A. (1985). Cognitive and motivational functions of imagery in human performance. *Canadian Journal of Applied Sport Sciences, 10,* 22-28.

Pie, J. S., Tenenbaum, G., Bar-Eli, M., Eyal, N., Levy-Kolker, N., Sade, S. (1996). Imagery orientation and vividness: Their effect on motor skill performance. *Journal of Sport Behavior, 19,* 32-48.

Pollock, B. J., & Lee, T. D. (1992). Effects of the model's skill level on observational motor learning. *Research Quarterly for Exercise and Sport 63,* 25-29.

Richardson, A. (1967). Mental practice: A review and discussion: Part 1. *Research Quarterly, 38,* 95-107.

Richardson, A. (1969). *Mental Imagery*. NY: Springer.

Rodgers, W., Hall, C., & Buckolz, E. (1991). The effect of an imagery training program on imagery ability, imagery use, and figure skating performance. *Journal of Applied Sport Psychology, 3,* 109-125.

Rodgerson, L. J., & Hrycaiko, D. W. (2002). Effect of a mental training package on endurance performance. *Journal of Applied Sport Psychology 14,* 14-26.

Ross, W. D. (Ed.). (1931). *The works of Aristotle translated into English* (Vol. 3). Oxford: Oxford University Press.

Rushall, B. S. (1988). Covert modeling as a procedure for altering an elite athlete's psychological state. *The Sport Psychologist, 2,* 131-140.

Russell, D. (1993). The effects of prototypic examples and video replay on adolescent girls' acquisition of basic field hockey skills. *Microform Publications, Int'l Institute for Sport and Human Performance*, University of Oregon. 35-45.

Sackett, R. S. (1934). The influences of symbolic rehearsal upon the retention of a maze habit. *Journal of General Psychology, 13,* 113-128.

Sackett, R. S. (1935). The relationship between amount of symbolic rehearsal and retention of a maze habit. *Journal of General Psychology, 13,* 113-128.

Salmela, J. H., Fiorito, P. (1979). Visual cues in ice hockey goaltending. *Canadian Journal of Applied Sport Sciences, 4,* 56-59.

Shepard, R. N. (1978a). Externalization of mental images and the act of creation. In B. S. Randhawa & B. F. Coffman (Eds.), *Visual learning, thinking and communication* (pp. 133-189). London: Academic Press.

Shepard, R. N. (1978b). The mental image. *American Psychologist, 33,* 125-137.

Singer, R. N., & Janelle, C. M. (1999). Determining sport expertise: From genes to supremes. *International Journal of Sport Psychology, 30*, 117-150.

Skinner, C. H., Hurst, K. L., Teeple, D. F., & Meadows, S. O. (2002). Increasing on-task behavior during mathematics independent seat-work in students with emotional disturbance by interspersing additional brief problems. *Psychology in the Schools, 39,* 647-654.

Smith, D. (1987). Conditions that facilitate the development of sport imagery training. *The Sport Psychologist, 1*, 237-247.

Smith, R. (2002). Video analysis software can enhance athlete performance. *American Football Monthly, 8,* 19-21.

Smith, M. L., & Glass, G. V. (1987). *Research and evaluation in education and the social sciences.* Englewood Cliffs, NJ: Prentice-Hall.

Smith, D., Holmes, P., Whitmore, L., Collins, D., & Devonport, T. (2001). The effect of theoretically-based imagery scripts on field hockey performance. *Journal of Sport Behavior, 24*, 408-420.

Start, K. B., & Richardson, A. (1964). Imagery and mental practice. *British Journal of Educational Psychology, 34,* 280-284.

Straub, W. F. (1989). The effect of three different methods of mental training on dart throwing performance. *The Sport Psychologist, 3,* 133-141.

Suinn, R. M. (1972). Removing obstacles to learning and performance by visuo-motor behavior rehearsal. *Behavior Therapy, 3*, 308-310.

Suinn, R. M. (1985). Imagery rehearsal applications to performance enhancement. *The Behavior Therapist, 8,* 155-159.

Suinn, R. M. (1986). *Seven steps to peak performance: The mental training manual for athletes.* Toronto and Lewiston, N.Y. H. Huber Publisher.

Tawney, J. W., & Gast, D. L. (1984). Chapter 8. The visual analysis of graphic data. In J. W. Tawney & D. L. Gast. Single subject research in special education (pp. 54-78). Columbus, OH: Charles E. Merrill Publishing.

Ulman, J. D., & Sulzer-Azaroff, B. (1975). Multi-element baseline design in educational research. In E. Ramp and G. Semb (Eds.). Behavior analysis: Areas of research and application (pp.111-187). Englewood Cliffs, N. J.: Prentice-Hall, Inc.

Van Wieringen, P. C. W., Emmen, H. H., Bootsma, R. J., Hoogesteger, M., & Whiting, H. T. A. (1989). The effect of video-feedback on the learning of the tennis service by intermediate players. *Journal of Sport Sciences, 7,* 153-162.

Vadocz, E. A, Hall, C. R., & Moritz, S. E. (1997). The relationship between competitive anxiety and imagery use. *Journal of Applied Sport Psychology, 9,* 241-253.

Vealey, R. S. & Greenleaf, C. A. (1998). Seeing is believing: Understanding and using imagery in sport. In J. M. Williams (Ed.), *Applied Sport Psychology*: Personal growth to peak performance (pp. 237–269). Mountain View, CA: Mayfield Publishing Company.

Vealey, R. S., & Walter, S. M. (1993). Imagery training for performance enhancement and personal development. In J. M. Williams (Ed.). Applied sport psychology: Personal growth to peak performance (2nd ed., pp. 200-224). Mountain View, CA: Mayfield.

Vickers, J. N., Livingston, L. F., Umeris-Bohnert, S., & Holden, D. (1999). Decision training: The effects of complex instruction, variable practice and reduced delayed feedback on the acquisition and transfer of a motor skill. *Journal of Sport Sciences, 17,* 357-367.

Wagner, K. E. (1992). Overcorrection and timeout techniques to decrease time off-task during a gross motor performance of emotionally disturbed males. Microform Publications, College of Human Development and Performance. University of Oregon.

Watson, J. B. (1931). *Behaviorism.* (2nd edition). London: Kegan Paul.

Weber, R. C., & Hanna, M. (1998). Kinematic analysis of gait changes in a female with maple syrup urine disease subsequent to participation in an adapted physical education program: a case study. *Journal of the International Council for Health, Physical Education, Recreation, Sport and Dance, 34,* 42-49.

Weinberg, R. S. (1982). The relationship between mental preparation strategies and motor performance: A review and critique. *Quest, 33,* 738-734.

Weismer, S. E., Murray-Branch, J., & Miller, J. F. (1993). Comparison of two methods for promoting productive vocabulary in late talkers. *Journal of Speech & Hearing Research, 36,* 1037-1050

White, A., & Hardy, L. (1995). Use of difference imagery perspectives on the learning and performance of different motor skills. *British Journal of Psychology, 86,* 169-180.

White, A., & Hardy, L. (1998). An in-depth analysis of the uses of imagery by high-level slalom canoeists and artistic gymnasts. *The Sport Psychologist, 12,* 387-403.

Wilk, B. R., Fisher, K. L., Gutierrez, W. (2000). Defective running shoes as a contributing factor in plantar fasciitis in a triathelte. *Journal of Orthopaedic & Sport Physical Therapy, 30,* 21-31.

Williams, A. M. (2000). Perceptual skills in soccer: Implications for talent identification and development. *Journal of Sport Sciences, 18,* 737-750.

Williams, A. M., & Grant, A. (1999). Training perceptual skill in sport. *International Journal of Sport Psychology, 30,* 194-220.

Wolko, K. L., Hrycaiko, D. W., & Martin, G. L. (1993). A comparison of two self-Management package to standard coaching for improving practice performance of gymnasts. *Behavior Modification, 17,* 209-223.

Wollman, N. (1986). Research on imagery and motor performance: Three methodological suggestions. *Journal of Sport Psychology, 8,* 135-138.

Woolfolk, R. L., Murphy, S. M., Gottesfeld, D., & Aitken, D. (1985). Effects of mental rehearsal of task motor activity and mental depiction of task outcome on motor skill performance. *Journal of Sport Psychology, 7,* 191-197

Woolfolk, R., Parrish, W., & Murphy, S. M. (1985). The effects of positive and negative imagery on motor skill performance. *Cognitive Therapy and Research, 9,* 235-241.

Wrisberg, C. A., & Anshel, M. H. (1989). The effects of cognitive strategies on the free throw shooting performance of young athletes. *The Sport Psychologist, 3,* 95-104.

Wrisberg, C. A., & Ragsdale, M. R. (1979). Cognitive demand and practice levels: Factors in mental rehearsal of motor skills. *Journal of Human Movement Studies, 5,* 201-208.

Yin R. K. (1994) *Case Study Research: Design and Methods*. Applied Social Research Methods Series, Volume 5. Sage Publications, Thousand Oaks, CA.

Zaichkowsky, L. D. (1980). Single-case experimental design and sport psychology research. In C. H., Nadeau, W. R., Halliwell, K. M., Newell, & G. C., Roberts (Eds.). Psychology of Motor Behavior and Sport-1979 (pp. 171-179). Champaign, IL: Human Kinetics.

Table 1

Descriptive Statistics on SIQ

	Participant 1			Participant 2		
Functions	Pre M	Post M	D	Pre M	Post M	D
CG	3.00	3.17	+0.17	4.00	4.33	+0.33
CS	3.00	3.57	+0.57	4.14	5.00	+0.86
MG-A	2.00	3.33	+1.33	4.00	4.17	+0.17
MG-M	3.83	4.00	+0.17	4.67	4.50	-0.17
MS	2.00	3.00	+1.00	4.00	4.17	+0.17

Table 2

Save Percentages

Phase	Participant 1		Participant 2	
	Shots	Save Percentage	Shots	Save Percentage
Standardization	23/25	92.00%	21/26	80.78%
Baseline	18/22	81.18%	9/14	64.29%
Imagery	11/11	100.00%	10/13	76.92%
Video	11/14	78.57%	8/9	88.89%

Table 3

Save totals

		Participant 1				Participant 2			
Date	Time	Phase	Shots	Saves	Percent	Phase	Shots	Saves	Percent
Jan 7	10:30-12:30	Stand	4	4	100	Stand	3	3	100
Jan 8	Game								
Jan 9	4:50-5:50	Stand	1	1	100	Stand	4	3	75
Jan 10	11:00-12:00	Stand	3	3	100	Stand	2	2	100
Jan 13	11:00-1:00	Stand	0	0	N/A	Stand	6	4	67
Jan 14	10:30-12:30	Stand	7	6	86	Stand	2	2	100
Jan 15	No goalies								
Jan 16	4:50-5:50	Stand	3	2	67	Stand	1	1	100
Jan 17	Game								
Jan 20	Off ice								
Jan 21	10:30-12:30	Stand	5	5	100	Stand	4	3	75
Jan 22	No shots								
Jan 23	4:50-5:50	Stand	2	2	100	Stand	4	3	75
Jan 24	Game	t	4	3	100	Stand	4	3	75
Jan 27	Off ice								
Jan 28	10:30-12:30	Baseline	3	2	67	Baseline	2	1	50

Jan 29	No shots								
Jan 30	4:50-5:50	Baseline	11	8	73	Baseline	8	5	63
Jan 31	Game								
Feb 3	Off ice								
Feb 4	10:30-12:30	Baseline	4	4	100	Baseline	3	2	67
Feb 5	Practice goalie in								
Feb 6	4:50-5:50	Baseline	4	4	100	Baseline	1	1	100
Feb 7	Game								
Feb 8	Off ice								
Feb 10	Off ice								
Feb 11	10:30-12:30	Imagery	4	4	100	Video	3	3	100
Feb 12	3:45-4:45	Video	3	3	100	Imagery	6	4	67
Feb 13	4:50-5:50	Imagery	1	1	100	Video			N/A
Feb 14	11:00-12:00	Video	4	3	75	Imagery	3	3	100
Feb 17	11:00-1:00	Imagery	2	2	100	Video	4	3	75
Feb 19	1:00-2:30	Video	5	3	60	Imagery	3	3	100
Feb 20	11:00-12:30	Imagery	4	4	100	Video	2	2	100
Feb 21	1:00-2:15	Video	2	2	100	Imagery	1	1	100

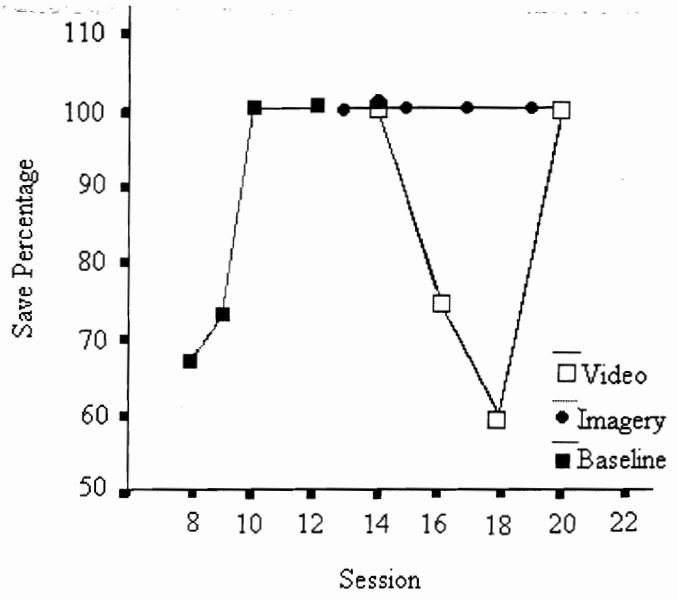


Figure 1. Investigates Participant 1's save percentage over the baseline, and imagery and video intervention phase

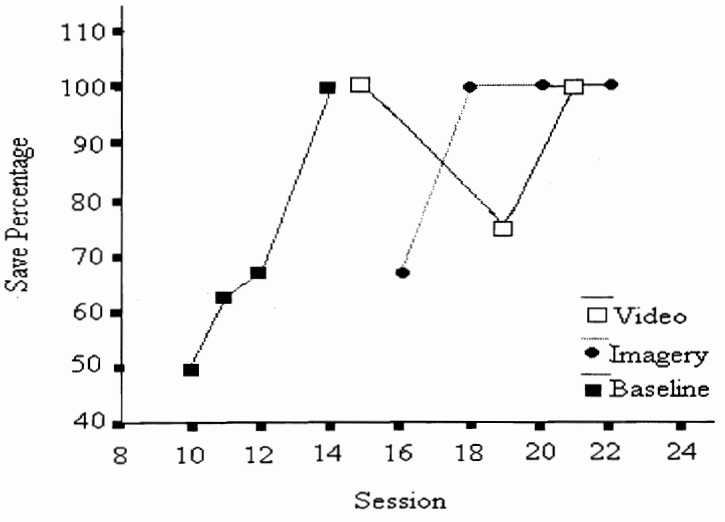


Figure 2. Investigates Participant 2's save percentage over the baseline, and imagery and video intervention phase

APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

1) Birth date: _____
(Year/month/day)

2) Which hand is your glove hand?_____

3) What hockey team and level did you play at before playing for Brock
_____ _____

4) How many years were you associated with the above
team?_____

5) How many years have you competed on the Brock hockey
team?_____

6) Do you know what imagery is? If yes please
define_____
_____

7) Have you ever used imagery?_____

8) If so, when and how
often?_____

9) How often do your images last
(minutes)?_____

10) Circle the example that best represents your imagery:

*When I image I'm looking at the play coming towards me through my cage.

*When I image I see plays develop as if I'm watching them on T.V.

11) Have you ever used game film?_____

12) If so, when and how
often?_____

13) What things do you pay attention to when viewing game
tape?_____ _____

Movement Imagery Questionnaire Revised

This questionnaire concerns two ways of *mentally* performing movements which are used by some people more than by others, and are more applicable to some types of movements than others. The first is attempting to form a visual image or picture of a movement without actually doing the movement. You are requested to do both of these mental tasks for a variety of movements in this questionnaire, and then rate how easy/difficult you found the task to be. The ratings that you give are not designed to assess the goodness or badness of the way you perform these mental tasks. They are attempts to discover the capacity individuals show for performing these tasks for different movements. There are no right or wrong rating or some ratings that are better than others.

Each of the following statements describes a particular action or movement. Read each statement carefully and then actually perform the movement as described. Only perform the movement a single time. Return to the starting position for the movement just as if you were going to perform the action a second time. Then depending on which of the following you are asked to do, either (1) form as clear a vivid a visual image as possible of the movement just performed, or (2) attempt to feel yourself making the movement just performed without actually doing it.

After you have completed the mental task required, rate the ease/difficulty with which you were able to do the task. Take your rating form the following scale. Be as accurate as possible and take as longs as you feel necessary to arrive at the proper rating for each movement. You may choose the same rating for any number of movements "seen" or "felt" and it is not necessary to utilize the entire length of the scale.

RATING SCALE

VISUAL IMAGERY SCALE

7	6	5	4	3	2	1
Very easy to see	Easy to see	Somewhat easy to see	Neutral (not easy nor hard)	Somewhat hard to see	Hard to see	Very hard to see

Kinesthetic Imagery Scale

7	6	5	4	3	2	1
Very easy to feel	Easy to feel	Somewhat easy to feel	Neutral (not easy nor hard)	Somewhat hard to feel	Hard to feel	Very hard to feel

1. Starting Position: Stand with your feet and legs together and your arms at your sides.

Action: Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:_____

2. Starting Position: Stand with your feet slightly apart and your hands at your sides.

Action: Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your sides.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with a clear and vivid a visual image as possible. Now rate the ease/difficulty with which you are able to do this mental task.

Rating:_____

3. Starting Position: Extend the arm of your nondominant hand straight out to your side so that it is parallel to the ground, palm down.

Action: Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:_____

4. Starting Position: Stand with your feet slightly apart and your arms fully extended above your head.

Action: Slowly bend forward at the waist and try and touch your toes with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above you head.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with a clear and vivid a visual image as possible. Now rate the ease/difficulty with which you are able to do this mental task.

Rating:_____

5. Starting Position: Stand with your feet slightly apart and your hands at your sides.

Action: Bend down low and jump straight up in the air as high as possible with arms extended above your head. Land with your feet apart and lower your arms to your sides.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:_____

6. Starting Position: Stand with your feet and legs together and your arms at your sides.

Action: Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with a clear and vivid a visual image as possible. Now rate the ease/difficulty with which you are able to do this mental task.

Rating:_____

7. Starting Position: Stand with your feet slightly apart and your arms fully extended above your head.

Action: Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.

Mental Task: Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating:_____

8. Starting Position: Extend the arm of your nondominant hand straight out to your side so that it is parallel to the ground, palm down.

Action: Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with a clear and vivid a visual image as possible. Now rate the ease/difficulty with which you are able to do this mental task.

Rating:_____

APPENDIX C

IMAGERY USE

Sport Imagery Questionnaire

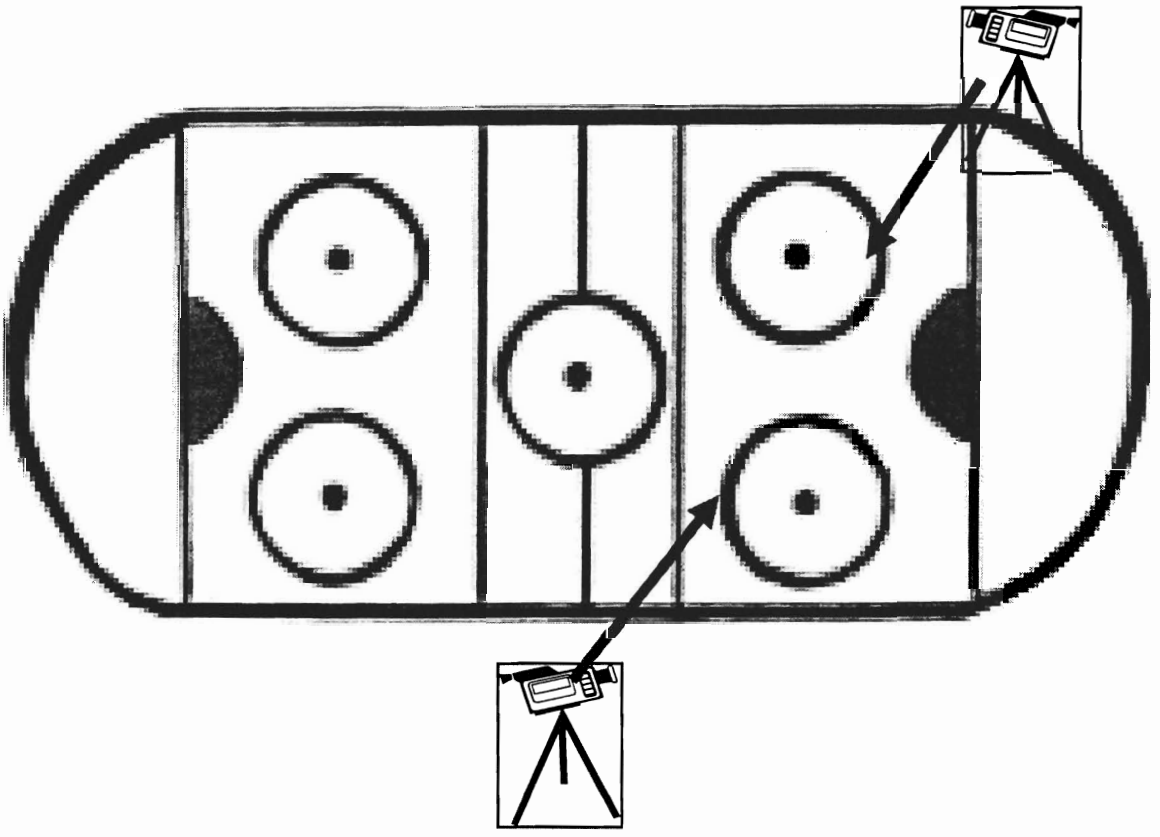
Rate the extent to which each of the statements apply to your imagery use across the following scale

1	2	3	4	5
Never	**Rarely**	**Sometimes**	**Often**	**Always**

1. I make up new plans/strategies in my head.
2. I image the atmosphere of winning a championship (e.g., the excitement that follows winning a championship).
3. I imagine giving 100%.
4. I can consistently control the image of a physical skill.
5. I imagine the emotions I feel while doing my sport.
6. I imagine my skills improving.
7. I image alternative strategies in case my event/game plan fails.
8. I imagine myself handling the arousal and excitement associated with my sport.
9. I imagine myself appearing self-confident in front of my opponents.
10. I imagine other athletes congratulating me on a good performance.
11. I image each section of an event/game (e.g., offense vs. defense, fast vs. slow).
12. I imagine winning.
13. I imagine myself being in control in difficult situations.
14. I can easily change an image of a skill.
15. I image others applauding my performance.
16. When imaging a particular skill, I consistently perform it perfectly in my mind.
17. I image myself winning a medal.
18. I imagine the stress and anxiety associated with my sport.
19. I image myself continuing with my game/event plan, even when performing poorly.
20. When I image myself performing, I feel myself getting psyched up.
21. I can mentally make corrections to physical skills.
22. I imagine executing entire plays/programs/sections just the way I want them to happen in an event/game.
23. Before attempting a particular skill, I imagine myself performing it perfectly.
24. I imagine myself being mentally tough.
25. When I image myself participating in my sport, I feel anxious.
26. I imagine the excitement associated with performing.
27. I image myself being interviewed as a champion.
28. I imagine to be focused during a challenging situation.
29. When I learn a new skill, I imagine myself performing it perfectly.
30. I imagine myself successfully following my game/event plan.
31. I image myself working successfully through tough situations (e.g., a power play, sore ankle, etc.).

APPENDIX D

ARENA CAMERA SET-UP



APPENDIX E

POST-INTERVENTION QUESTIONNAIRE

1) What do you think could be improved in this study for future research?_____

2) Did the interventions produce any effect? If so what?_____

3) Which intervention (i.e., imagery or video feedback) had the greatest effect on you and why

_____

4) Did you stick to the imagery scripts provided?_____

5) If not, how did you modify them? _____

6) How often did you image?_____

7) What were your thoughts regarding your input into the imagery script?

_____

8) How often did you watch your video? _____

9) How did you use the video? _____

10) Would you participate in another study like this? Why or why not?

_____

11) Would you recommend this type of study being applied to other avenues of your sport? Why or why not? _____

12) Would you recommend others to participate in this kind of study? Why or why not?_____

APPENDIX F

BROCK ETHICS APPROVAL

DATE: January 09, 2003

FROM: Joe Engemann, Chair Senate Research Ethics Board (REB)

TO: Diane Stevens, Physical Education and Kinesiology

Kyle Brownell

FILE: 02-127, Brownell

TITLE: Imagery or Video Feedback Which is the "Route" to Strategic Improvement?

The Brock University Research Ethics Board has reviewed the above research proposal.

DECISION: Accepted as clarified.

This project has been approved for the period of January 09, 2003 to May 17, 2003 subject to full REB ratification at the Research Ethics Board's next scheduled meeting. The approval may be extended upon request. *The study may now proceed.*

Please note that the Research Ethics Board (REB) requires that you adhere to the protocol as last reviewed and approved by the REB. The Board must approve any modifications before they can be implemented. If you wish to modify your research project, please refer to www.BrockU.CA/researchservices/forms.html to complete the appropriate form *REB-03 (2001) Request for Clearance of a Revision or Modification to an Ongoing Application.*

Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Principal Investigator, the safety of the participants and the continuation of the protocol.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research protocols.

The Tri-Council. Policy Statement requires that ongoing research be monitored. A Final Report is required for all projects, with the exception of undergraduate projects, upon completion of the project. Researchers with projects lasting more than one year are required to submit a Continuing Review Report annually. The Office of Research

Services will contact you when this form *REB-02 (2001) Continuing Review/Final Report* is required.

Please quote your REB file number on all future correspondence.

Deborah Van Oosten
Research Ethics Officer
Brock University http://www.brocku.ca/researchservices/
St. Catharines, Ontario L2S 3A1
phone: (905) 688-5550, ext. 3035 fax: (905) 688-0748

APPENDIX G

TECHNICAL ADVISOR CONSENT FORM

Brock University, Faculty of Applied Health Sciences
Statement of Confidentiality- Technical Advisor
Title of Study: Imagery and Video Feedback: The "Route" to Strategic Improvement?"
Principal Researcher: Kyle J. Brownell, Department Physical Education and Kinesiology
Supervising Professor: Diane Stevens Ph.D.
Name of Technical Advisor: (please print)

_____

Please read the following:
An important part of conducting research is having respect for privacy and confidentiality:
Respect for human dignity also implies the principles of respect for privacy and confidentiality. In many cultures, privacy and confidentiality are considered fundamental to human dignity. Thus, standards of privacy and confidentiality protect the access, control and dissemination of personal information. In doing so, such standards help to protect mental or psychological integrity. They are thus consonant with values underlying privacy, confidentiality and anonymity respected.
[From the Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans, August 1998].

Out of respect for human dignity and people's right to privacy we ensure our research participants both anonymity and confidentiality.
Researchers protect privacy by not disclosing a participant's identity after information is gathered (Neuman, 1991). A respondent may be considered *anonymous* when the researcher cannot identify a given response with a given respondent (Babbie, 1992, p. 467). While the identity of the participant has been removed from tapes and transcripts and replaced with a pseudonym, other references that identify other people and organizations have not been removed. In signing below you are agreeing to respect the participant's right to privacy and that of the people that are referred to in the research.

In signing below you are indicating that you understand the following:
I understand the importance of providing anonymity and confidentiality to research participants.
I understand that this information is to be kept confidential.
I understand that the contents of the video are not to be discussed outside of research meetings with the Principal Investigator.
I understand that data files (electronic and hard copy) are to be secured at all times (e.g., not left unattended).
In signing my name below, I agree to the above statements and promise to ensure the participants in this study anonymity and confidentiality.

Signature of the Technical Advisor: _____ Date: _____

I have fully explained the issues of anonymity and confidentiality to the above Technical Advisor.

Researchers Signature: _____

Date: _____

APPENDIX H

LETTER OF INTRODUCTION

Dear Participant, January 2003

Thank you for your potential participation. The research project that you are being asked to participate in is entitled, "Imagery or Video Feedback Which is the "Route" to Strategic Improvement". Kyle Brownell a Master's candidate at Brock University is conducting the study, under the supervision of Dr. Diane Stevens from the faculty of Applied Health Sciences. Mr. Brownell's main interest lay in performance enhancement. The purpose of this study is to examine which performance enhancing technique (i.e., imagery or video) will have the greatest impact on performance.

Your involvement and feedback will aid in the construction of future performance enhancement programs and is greatly appreciated. You will be asked to complete a demographic questionnaire, the Sports Imagery Questionnaire (SIQ), the Movement Imagery Questionnaire Revised (MIQ-R) and a post-intervention questionnaire. As well you will be asked to participate in an imagery and video intervention spanning five-weeks.

The study that you are being asked to participate in will also include the other two goaltender from your team. Results from this study will be used to enhance training techniques for goaltenders. A written summary of the findings will be made available to you upon completion of the study. Further dissemination will occur in academic journals and conference presentations; however, the specific identity of your team and the participants in the study will not be disclosed. Any information provided from the participants will be treated with confidentiality and access to information that might identify participants will be limited to Kyle Brownell, Dr. Diane Stevens, Murray Nystrom and an expert goalie coach. Murray Nystrom and an expert goalie coach will be the ones accessing your performance and they will have completed a confidentially agreement. The names of specific participants in the study will not be attached to video's or questionnaires for any purposes. All original videotapes and questionnaires will be destroyed following completion of the study. Participation in this study is voluntary and individuals may decline answering any question(s) within the questionnaire that they find invasive, offensive or inappropriate. Participants may withdraw from the study at any stage in the process. Of course, people may choose not to participate and will not experience negative consequences or penalty.

Following the completion of our study we would gladly send you a summary of our results. Should you have any further questions concerning the study, please contact Kyle Brownell at (905) 688-5550, ext. 3599 or Dr. Diane E. Stevens at (905) 688-5550, ext. 4360 or Murray Nystrom, ext. 4368.

Thank you for your interest and involvement in this study

Sincerely,

Kyle Brownell
MA Candidate
Department of Physical Education and Kinesiology

APPENDIX I

INFORMED CONSENT

BROCK UNIVERSITY - DEPARTMENT OF PHYSICAL EDUCATION

Informed Consent Form

Title of Study: "Imagery and Video Feedback: The "Route" to Strategic Improvement?"

Researcher: Kyle J. Brownell

Supervising Professor: Diane Stevens, Ph.D., Kelly Lockwood, Ph.D., and Kimberley L. Gammage, Ph.D.

Technical Advisor: Murray Nystrom (Men's hockey head coach)

Name of Participant: (Please print) _____

I understand that the study in which I have agreed to participate involves an investigation into the effects of imagery and video feedback on strategic play. I will be asked to complete a demographic questionnaire, the Sports Imagery Questionnaire (SIQ), the Movement Imagery Questionnaire Revised (MIQ-R) and a post-intervention questionnaire. As well I will be asked to participate in an imagery and video intervention spanning four-weeks.

I understand that my participation in this study is voluntary and that I may withdraw from the study at any time and for any reason without penalty. There are no known physical or psychological risks associated with participation in this project. I also understand that there will be no compensation for my participation. I further understand that there is no obligation to answer any question or participate in any aspect of this project that I consider invasive, offensive or inappropriate.

I understand that all personal data will be kept strictly confidential and that all information will be coded (according to month and day) so that my name is not associated with my answer. I understand that only the researchers named above will have access to the data.

Participant Signature_____ Date_____

This study has been reviewed and approved by the Brock Research Ethics Board. (File #)

If you have any questions or concerns about your participation in the study, you may contact **Kyle J. Brownell** ***at (905) 688-5550, ext. 3599, Diane E. Stevens, ext. 4360, Kelly Lockwood, ext. 3092, Kimberley L Gammage, ext. 3772 or Murray Nystrom, ext. 4368.***

Feedback about the use of the data collected will be available upon completion of the study. A written explanation will be provided for you upon request.

Thank you for your help!! ***Please take one copy of this form with you for further reference.***

* * * *

I have fully explained the procedures of this study to the above volunteer.

Researcher Signature_____ Date_____

APPENDIX J

IMAGERY HANDOUT

IMAGERY SCRIPT ESSENTIALS

An imagery is a written account of all the details you should be attending to when performing each of the scenarios. So, if I were to ask you to tell me all the relevant things you should do to make the perfect save, you would be able to document them sequentially. An imagery script just involves writing them down. Once you have them written down, this is how you will be asked to image the play. Imagery scripts should be constructed to An imagery script is a written account of all the details that you imagine when imaging. Imagery scripts should be constructed to suit your individual preferences/perspective. If you are a visual imagery (you see the image) or kinesthetic imagery (you feeling the image in your muscles) you should try to stick to that perspective. Visual imagery can be divided into two groups. An internal perspective, which means you image as if you were actually playing. For example you would visualize looking through your cage and see the bars. The second is an external perspective, which is from a third person perspective. For example watching yourself on a tape.

Imagery scripts should be vivid. Vividness is the clarity, sharpness, colour, and realness of the situation imaged. It may include the senses of touch, taste, hearing, and seeing depending on your perspective.

Three important characteristics of imagery scripts are termed propositions. The first are *Stimulus Propositions*, which reflect the external environment. For example, the distance of the shooter to the net and the coldness of the arena. *Response Propositions* are your physical reactions to the situation. For example, motor actions, such as stacking your pads and autonomic changes such as sweating and increased heart rate as the puck comes closer to you. *Meaning Propositions* are the significance/importance of the event. For example, does making this save mean you don't have to skate the rest of the practice.

I would like you to construct one imagery script for each of the plays: (1) a right-handed point shot with a defenceman in front of the net; (2) a right-handed point shot with a defenceman battling a forward in front of the net; (3) a right-handed point shot with a defenceman in front of the net with an on coming forward cutting at the mid point of the circle. Your introduction to the scene can be the same in parts but please differentiate things that you would do differently for each situation. Make sure to include things such as your style (e.g., if you are a stand up or butterfly goalie). You will be asked to hand in your script and I will examine it and return it to you. It may be changed minimally to include information provided by the expert goaltending coach.

Have fun with this and make it as detailed as possible. Please have this completed by Monday or sooner. You can email your scripts (total of three) to me at kylebrownell@hotmail.com. If you have any questions please don't hesitate to contact me. Thanks for your time and participation.

APPENDIX K

IMAGERY SCRIPTS

Imagery Scripts

First I would like you to close your eyes and take three deep breaths. With each breath clear your mind until you feel an 'energized' but relaxed state. Now with your mind-cleared image yourself surrounded by the crease and the net. You are centered in the net with your back against the cross bar. Take three more deep breaths and sharpen your image of yourself standing in the net. You are feeling totally comfortable in the ready position. Your knees are bent ready to spring into action. Your trapper is open ready to catch anything that comes it's way. Your trapper and blocker are both at the same height a little in front of your knees. You can feel the increase in the girth of your legs with the pads on. Feel the weight and dampness of your equipment and the cool air of the arena across your face. You can see a white fog emerge each time you exhale. You are now in a solid stable position with your stick out at a small angle far enough so your skates don't touch your stick. Your head is up ready to track the puck.

Now visualize the black puck on the opposing defencman's stick at the blueline. You now start lining up your belly button with the point shot and become square to the shot. You start to tighten up and are totally focused. The puck is 1.5 feet away from the boards to your left side. Your legs and arms are working independently. You push off with your right foot to get into the proper angle coverage, while your upper body stays still. You are now properly positioned, 45 degrees to the shooter and covering the short side. You are slightly leaning forward. You are able to move in any direction: left, right, front or back in a good balanced position. You can feel your weight and that of the equipment on the balls of your feet. You feel sweat dripping down your face. You know that you need to make this save to keep your team in the game to give them a chance to win. You see the defenceman's stick leave the ice during the back swing of his slapshot. You do a peripheral vision check. Thus making sure no one is around. You are able to look with precision and are able to refocus on the puck almost instantaneously. You decide without the presence of any attacking forwards to come out to the top of the crease to cut down the angle. You have the net so well covered that not even daylight can sneak through. You now get a little lower in your stance and are ready to go down. You are totally focused on the defenceman's stick whipping through the air. You initiate some backward motion. His stick makes a tremendous cracking noise as it hits two inches before the puck followed by another when he hits the puck. You see the stick is really flexed and you anticipate a blazing shot. You wait to see if the shot is low or high. The black puck is whistling through the air three inches above the ice. The shot is low, so you drop to your knees in your butterfly. Your legs are out as far as you can possibly stretch them. You follow the puck off the defenceman's stick and turn your head to see it hit your stick. You angle your stick in a manner to deflect the puck in the left corner. Immediately after the save you get up to your feet and follow the puck with your eyes to the corner. You put your self flush with the post. Once the puck is out of harms way you back into the center of the net and rest your back on the crossbar again until the next situation

First, I would like you to close your eyes and take three deep breaths. With each breath clear your mind until you feel an 'energized' but relaxed state. Now with your mind-cleared image yourself surrounded by the crease and the net. You are centered in the net with our back against the cross bar. Take three more deep breaths and sharpen your image of yourself standing in the net. You are feeling totally comfortable in the ready position. Your knees are bent ready to spring into action. Your trapper is open ready to catch anything that comes it's way. Your trapper and blocker are both at the same height a little in front of your knees. You can feel the increase in the girth of your legs with the pads on. Feel the weight and dampness of your equipment and the cool air of the arena across your face. You can see a white fog emerge each time you exhale. You are now in a solid stable position with your stick out at a small angle far enough so your skates don't touch your stick. Your head is up ready to track the puck.

From the corner of you eye you see an opposing player breaking down the right side headed towards the net. This quickly approaching player is a left handed shot which makes him dangerous because he can one time the shot, redirect or receive a pass and make a move. The opposing player initiates a cut into the center of the ice between the top of the circle and the face off dot. You can hear the cutting of his blades into the ice. Now visualize the black puck on the opposing defencman's stick at the blueline. You now start lining up your belly button with the point shot and become square to the shot cheating a little to the wide side because of the on coming player. The sound of the opposing player's skates cutting the ice are getting closer. You start to tighten up and are totally focused The puck is 1.5 feet away from the boards to your left side. Your legs and arms are working independently. You push off with your right foot to get into the proper angle coverage, while your upper body stays still. You are now properly positioned, 45 degrees to the shooter and still cheating to the right side because of the pass option. You are slightly leaning forward. You are able to move in any direction: left, right, front or back in a good balanced position. You can feel your weight and that of the equipment on the balls of your feet. You feel sweat dripping down your face. You know that you need to make this save to keep your team in the game to give them a chance to win. You see the defenceman's stick leaving the ice during the back swing of his slapshot. You do a peripheral vision check to mark the oncoming player, thus reinforcing their position. You are able to look with precision and are able to refocus on the puck almost instantaneously. You decide because of the presence of an attacking forward to stay deeper in your crease. You have the net so well covered that not even daylight can sneak through. You sink a little lower in your stance. You are totally focused on the defenceman's stick whipping through the air. Waiting to see if the shot is high or low. You initiate some backward motion. His stick makes a tremendous cracking noise as it hits two inches before the puck followed by another when he hits the puck. You see the stick is really flexed and you anticipate a blazing shot. The black puck is whistling along the ice in the direction of the streaking forward. Thus you dig your left foot in the ice quickly and thrust your self across the net. You can feel all your muscles firing. You realize that the shot/pass is too hard for a blazing one time and anticipate that the player will only be able to redirect the puck. You see the puck come across the player's body as he redirects the pass to the wide side. This causes you to slide across in the butterfly position. Your legs are as stretched as possible. You feel the puck hit your

right pad. Which results in the puck laying a few inches in front of you. You are quick to react and pulls the puck into your pads to end the drill. Once the puck is out of harms way I back into the centre on the net and rest my back on the crossbar again until the next situation.
First I would like you to close your eyes and take three deep breaths. With each breath clear your mind until you feel an 'energized' but relaxed state. Now with your mind-cleared image yourself surrounded by the crease and the net. You are centered in the net with your back against the cross bar. Take three more deep breaths and sharpen your image of yourself standing in the net. You are feeling totally comfortable in the ready position. Your knees are bent ready to spring into action. Your trapper is open ready to catch anything that comes it's way. Your trapper and blocker are both at the same height a little in front of your knees. You can feel the increase in the girth of your legs with the pads on. Feel the weight and dampness of your equipment and the cool air of the arena across your face. You can see a white fog emerge each time you exhale. You are now in a solid stable position with your stick out at a small angle far enough so your skates don't touch your stick. Your head is up ready to track the puck.

You see an opposing player in front of the net. He is standing two feet from the top of the crease. The offensive player has positioned him self for a screen. Your line of vision is obstructed. You stay low to look through or around the player in front. You notice that the offensive player's stick is in position to deflect the puck. His blade is angled to deflect the puck upwards. This cue allows you to prepare for alternative outcomes of the shot. You fight to keep your eyes on the puck.
Now visualize the black puck on the opposing defencman's stick at the blueline. You now start lining up your belly button with the point shot and become square to the shot, while negotiating around the man in front. You start to tighten up and are totally focused. The puck is 1.5 feet away from the boards to your left side. Your legs and arms are working independently. You push off with your right foot to get into the proper angle coverage, while your upper body stays still. You are now properly positioned, 45 degrees to the shooter and covering the short side. You are slightly leaning forward. You are able to move in any direction: left, right, front or back in a good balanced position. You can feel your weight and that of the equipment on the balls of your feet. You feel sweat dripping down your face. You know that you need to make this save to keep your team in the game to give them a chance to win. You catch a glimpse of the defenceman's stick leaving the ice during the back swing of his slapshot. You get as close as you can to the player to cut down the angle of deflection. You have the net so well covered that not even daylight can sneak through. You are totally focused on the defenceman's stick whipping through the air while remembering the position of the offensive player's stick. You initiate some backward motion. Waiting to see if the shot is high or low. His stick makes a tremendous cracking noise as it hits two inches before the puck followed by another when he hits the puck. You see the stick is really flexed and you anticipate a blazing shot. The black puck is whistling along the ice, which increases the danger of a deflection. The puck is heading right at the player in front of the net. You watch the puck come and are as close to the player as possible and drop onto your knees in the butterfly position. Your keep as tight as possible, your knees are together, with your arms at your side, while your stick is centered in front of you on the ice. The opposing

player quickly pulls his stick in towards his body and you hear the sound of rubber hitting wood. Within an instead the puck is headed up and you feel that familiar feeling of the puck striking your chest protector. The puck quickly falls and you corral it with your glove hand so the puck does not escape. You know a rebound could cause a lot of damage to the team.

First I would like you to close your eyes and take three deep breaths. With each breath clear your mind until you feel an 'energized' but relaxed state. Now with your mind-cleared image yourself surrounded by the crease and the net in the ready position. Take three more deep breaths and sharpen your image of yourself standing in the net. You are feeling totally comfortable in the ready position. Your knees are bent ready to spring into action. Your trapper is open ready to catch anything that comes it's way. Your trapper and blocker are both at the same height a little in front of your knees. You can feel the increase in the girth of your legs with the pads on. Feel the weight and dampness of your equipment and the cool air of the arena across your face. You can see a white fog emerge each time you exhale. You are now in a solid stable position with your stick out at a small angle far enough so your skates don't touch your stick. Your head is up ready to track the puck.

Now visualize the black puck on the white ice. The puck is on an opposing defencman's stick at the blueline. You now start lining up your belly button with the point shot and become square to the shot. The puck is 1.5 feet away from the boards to your left side. Your legs and arms are working independently. You push off with your right foot to get into the proper angle coverage, while your upper body stays still. You are now properly positioned, 45 degrees to the shooter and covering the short side. You are slightly leaning forward. You are able to move in any direction: left, right, front or back in a good balanced position. You can feel your weight and that of the equipment on the balls of your feet. You feel sweat dripping down your face. You see the defenceman's stick leave the ice during the back swing of his slapshot. You do a peripheral vision check. You are able to look with precision and are able to refocus on the puck almost instantaneously. You decide without the presence of any attacking forwards to come out to the top of the crease to cut down the angle. You have the net so well covered that not even daylight can sneak through. You are totally focused on the defenceman's stick whipping through the air. Everthing starts to slowdown and you see your breath rise. You initiate some backward motion. His stick makes a tremendous cracking noise as it hits two inches before the puck followed by another when he hits the puck. You see the stick is really flexed and you anticipate a blazing shot. The black puck is whistling through the air three inches above the ice. You go down. You feel that familiar feeling of the puck striking your left pad. The rebound is laying in front of your left pad for only a second before you glove grasps it.

First I would like you to close your eyes and take three deep breaths. With each breath clear your mind until you feel an 'energized' but relaxed state. Now with your mind-cleared image yourself surrounded by the crease and the net in the ready position. Take three more deep breaths and sharpen your image of yourself standing in the net. You are feeling totally comfortable in the ready position. Your knees are bent ready to spring into action. Your trapper is open ready to catch anything that comes it's way. Your trapper and blocker are both at the same height a little in front of your knees. You can feel the increase in the girth of your legs with the pads on. Feel the weight and dampness of your equipment and the cool air of the arena across your face. You can see a white fog emerge each time you exhale. You are now in a solid stable position with your stick out at a small angle far enough so your skates don't touch your stick. Your head is up ready to track the puck.

You see an opposing player in front of the net. He is standing two feet from the top of the crease. You notice that the opposing player is left-handed. You catalogue this because the puck may hit his sticks and cause a deflection. This information will aid you to construct the proper deflection coverage/position. Your line of vision is partially obstructed. His blade is angled to deflect the puck upwards. This cue allows you to prepare for alternative outcomes of the shot.

Now visualize the black puck on the white ice. The puck is on an opposing defencman's stick at the blueline. You now start lining up your belly button with the point shot and become square to the shot, while negotiating around the man in front. The puck is 1.5 feet away from the boards to your left side. Your legs and arms are working independently. You push off with your right foot to get into the proper angle coverage, while your upper body stays still. You are now properly positioned, 45 degrees to the shooter and covering the short side. You are slightly leaning forward. You are able to move in any direction: left, right, front or back in a good balanced position. You can feel your weight and that of the equipment on the balls of your feet. You feel sweat dripping down your face. You catch a glimpse of the defenceman's stick leaving the ice during the back swing of his slapshot. Your heart quickens. Because of the presence of the attacking forwards you decide to come out to the angle of deflection. You have the net so well covered that not even daylight can sneak through. You are totally focused on the defenceman's stick whipping through the air while remembering the position of the offensive player's stick. You initiate some backward motion. His stick makes a tremendous cracking noise like a tree falling in the woods as it hits two inches before the puck followed by another when he hits the puck. You see the stick is really flexed and you anticipate a blazing shot. The black puck is whistling along the ice, which increases the danger of a deflection. The puck is heading right at the man in front of the net. You drop to your knees making sure your pads are flat on the ice. Your stick is against both pads, while your arms are locked . Thus the only way the puck could beat you is to get past you. The opposing player quickly pulls his stick in towards his body and you hear the sound of rubber hitting wood. Within an instead the puck is headed up you fully extend and catch the puck. This keeps your team tied.

you at his mercy. The thought of this being the "big game" races through your mind. You know that there is only two seconds left. Your stick is on the ice so you know if he goes high your season is over. You quickly cradle the puck in towards and the crowd erupts. The game is still intact with two seconds left.